THE ELECTRICAL WORLD

VOL. IV.—No 24. NEW YORK, DECEMBER 13, 1884. {$3.00 PER ANNUM. {10 CENTS A COPY.

The Incandescent Light in Interior Decoration.

One of the most notable exhibits in electric lighting and the electrical transmission of power at the Electrical Exhibition, Philadelphia, was that of the Brush Electric Company, of Cleveland, O. Brush lamps shone conspicuously in various parts of the building, and the Swan incandescent lamps were displayed in a number of interior applications connected with the home, the office, the store and the factory. We have already illustrated and described the leading features of the generating system employed, such as the new dynamo with the laminated armature, the secondary battery and the manipulator. We now give an illustration of that portion of the exhibit which was especially attractive to the general public. The thought having struck the company that the best way to display the effect of the Swan incandescent lamps would be to show them in actual use, three rooms were built in the space allotted, and their furnished interiors represented a drawing room, a bed room, and an office and mill room. It will be remembered that last year we published some large illustrations showing the manner in which the same happy idea had been worked out at the Munich Exhibition; and it will be seen that the Brush Company made at Philadelphia an equally successful demonstration of the ease with which the incandescent light plays the part of a rich ornament and heightens in beauty every æsthetic effect of interior decoration. It is a significant fact, and one we cannot do wrong in emphasizing, that just as the world advances in civilization, it asks for better and better means of artificial illumination; and that having now discovered the purity and excellence of the electric light it asks, too, that by further development and improvement, the new light shall be brought into every house.

It was long ago settled that the artificial light employed should be something more than utilitarian. Hence it is that in many of the old lamps, relics of a dim antiquity, we meet with exquisite designs, and that in modern gas-fixtures the artist and the artisan have both produced many veritable works of art. Now, in due course, the electric light is playing its part as an accessory and as a stimulus in domestic æstheticism. Not alone has it carried to a higher pitch the standard of illumination, but, owing to the fact that the incandescent light will burn in any position or at any angle—buried in flowers, placed under water or swinging from the roof like fruit on a bough or a bunch of grapes on the vine—it exacts from the designer greater proofs than ever of his taste and skill.

The fine picture we give on this page is that of the drawing-room, fitted with Swan lamps fed from a Brush low-tension dynamo for direct incandescent lighting. The capacity of the machine was two hundred 20 candle-power lamps. This machine exhibits the same plan generally as the celebrated Brush dynamos for arc lighting, and is remarkable for its perfect self-regulation. The masses of iron in the field magnets and the armature core are naturally greater, and the coils are double wound, partially in shunt and partially in series. Owing to the closeness of regulation the lamps in circuit may be turned on or off in any number, and each of the remaining lamps burns without a flicker, in undiminished brilliancy, and this without regulating devices exterior to the machine itself. Two of these machines were run—one belting on the general shafting and the other belted direct to a Westinghouse engine. The speed is given at 1,160 revolutions, and the normal horse-power about twenty, with full circuit of lamps.

Coming to the lamps themselves, the features that specially attracted attention were the soft brilliancy of the light, the ease with which it could be moved about, and the elegance of the "electroliers" suspended from the ceiling, projecting from the wall, and placed upon the table. There are other points, however, which, not so obvious to the casual observer, are on examination discovered to be of the utmost importance. A room of the size indicated would, if lighted by gas, soon acquire

THE ELECTRIC LIGHT IN THE DRAWING-ROOM:—BRUSH CO.'S EXHIBIT, PHILADELPHIA.

an unnatural warmth, and the air would be seriously vitiated. Dr. Tidy states, as the result of his investigations, that each ordinary gas burner in a room consumes 5.45 cubic feet of oxygen per hour, depriving completely of its oxygen 17.25 cubic feet of air. A drawing-room of about the size shown in our illustration—say 16 feet long, 10 feet wide and 9 feet high—contains 1,440 cubic feet of air, so that not less than one-tenth of the oxygen in it would be consumed in eight hours by the gas of one burner, or all in 80 hours, if there were no renewal of the air. It need not be wondered, therefore that the introduction of the incandescent light is desired by those who want healthy homes, for it does not vitiate or heat the air at all.

Another point suggested by the picture is the good results attained in preservation of furniture and decorations by the use of the electric light. The room in question contained rich draperies, admirable oil paintings, and choice statuary, as well as delicate knicknacks and books in handsome bindings. Now in such a room gas is a very active agent of destruction, as its fumes will sooner or later discolor all kinds of fabrics, reduce leather to powder, rot and disintegrate gutta-percha, and rust metals. It is a fact well known to dealers in dry goods that the edges of dyed fabrics lose the color when kept any length of time on the top shelves of gas lighted stores. The use of the electric light is not attended by any of these deleterious effects, but as an artificial illuminant the electric light comes nearest sunshine.

The bed room included in the exhibit was decorated and arranged in a very tasteful manner, and the advantages of incandescent lighting were again signally displayed. In the third room, used as an office by the company, were two looms run by Brush electric motors, which are made up to a size developing over 40 h. p. actual. The desks were cheerfully illuminated by portable lamps, and the lights around the looms enabled every operation to be followed with fullest insight. The Brush Company are to be congratulated upon their rich and costly exhibit, comprising, as it did, so many elements of originality, taste and beauty.

Notes on the New Orleans Exposition.

(From Our Special Correspondent.)

New Orleans, Dec. 6, 1884.—Your accredited ambassador and minister plenipotentiary to the World's Exposition finds himself in a difficult position, for while corresponding with an electrical journal he is perpetually confronted with the formidable fact that the Exposition at New Orleans is not an electrical exhibition. Whatever laurels are added to the already lustrous crown of electricity at the World's Fair here must be earned by actual service rendered, its applications forming but a small fraction of the wondrous total of exhibits.

I strolled over the Exposition grounds yesterday, and picked up the following notes, and the absence of almost everything connected with the Exposition, save the buildings themselves must account for the meagreness of my information. The Exposition Park is about four miles up the river from Canal street, the commercial centre of the city, and lies at the river side.

The buildings consist of a main building, a horticultural hall, a machinery hall, a government and state building; the Mexican building; a separate iron building for the Edison electric light working plant; a house of public comfort, several hotels, and a coliseum, wherein a panorama of the battle of Sedan is to be displayed.

The principal or main building is 1,378 feet long, 905 feet wide, and has, including the ground and gallery floors, 1,656,300 square feet of space. This area is intersected by aisles having a total length of six miles. The building will be illuminated by 800 arc and 15,000 incandescent electric lights. In the centre, and opposite the grand entrance, is the Music Hall, which is capable of seating 7,000 people, and which has a large organ nearly completed. To the eye of an electrician the most interesting feature of the Music Hall is the way it is lighted. Incandescent electric light fixtures are suspended from the roof at numerous points, each carrying a cluster of Edison lamps, surmounted by an illuminated crescent, in honor of the Crescent City. Edison incandescent lights are also to be seen interspersed at suitable distances throughout the building.

The dynamos which are to energize these lamps are in a separate iron building, and the electricity is transferred to the main building by means of four circuits, the out and return wires being loosely twisted together. The Edison (?) arc lights are to be supplied from heavy dynamos located in the building, which will also serve as exhibits.

The Jenney arc light, one as yet unknown to me, is displayed upon numerous tall towers erected around the grounds, and also will aid materially in furnishing luminiferous ether for the building.

Up to date the only other light represented is that of the Louisiana Electric Light & Power Co., representing the Muller dynamos, and having an arc lamp, which is said to furnish a remarkably good and steady light.

Near the entrance on the extreme right will be the railroad ticket office, adjoining which will be the transportation department and telegraph office. To the right of the entrance on the eastern front near the northern end of this building the Department of the Press is to be established, with a liberal area of 6,276 feet. The Great Southern Telephone and Telegraph Co., representing the Bell Telephone, has done excellent work already in the main building, and is in fact much farther advanced than any other feature of the Exposition.

This company is ably represented by its president, E. S. Babcock, Jr., and the New Orleans manager, Mr. J. J. Fowler, who are rushing things in the Exposition and the city generally.

A section of the "justly celebrated" multiple switchboard is being set up, and it is confidently expected that 150 telephones will be rented by exhibitors and by the various agencies, while about 25 trunk wires will be erected between the Exhibition and the city central office. Mr. E. B. Temple is in charge of the exhibition work. There can be no doubt that the telephone department will be conducted in a masterly manner.

The gentlemanly opposition is here represented by a company having the style and title of "The National Improved Telephone Co., of Louisiana," and it controls the Randall patents and some of the Rogers inventions. It is of course naturally depressed by the decision of Judge Wallace, but stoutly maintains, nevertheless, that it does not infringe the Bell patents.

This company has from 20 to 30 wires run in the main building and intends to exhibit. As yet, however, it only has a remarkably good location and a single telephone outfit. So far as I can ascertain no other telephone has as yet made its appearance.

As regards electric locomotion, there is nothing done. Gen. E. C. Pike, of Boston, with another officer of the Daft Electric Power Co., was in the city this week arranging for an exhibit of the Daft system of the electric transmission of energy.

This company has been desirous of erecting and operating an electric railway in the main building, but its proposition to that effect has been considered and declined by the Building Committee. Negotiations are now, however, progressing for the operation of such a railway in the grounds outside of the building.

In the Horticultural Hall the effect of the electric light will be most superb.

The Thomson-Houston light will here be employed; the company exploiting the same is now placing fifty-four arc lights, four of which will hang in the top of the dome above the fountain, which will thus be illuminated. Nine arc lights will be placed on top of the dome which surmounts the building, and one arc light will overhang each of the four entrances. In the offices of this building incandescent lamps will be used. The fountain in the centre of the hall has the wall of its well covered with a two-foot capping, on which a coronet of rare and tropical potted plants will be placed. The effect of the lights upon this fountain will be indescribably beautiful.

It is to be regretted that the preparations for the Exposition in the main and government buildings are lamentably behindhand. While the formal opening of the Exposition is to take place on Dec. 16, it is quite certain that but a very small portion of the exhibits can by that time be in place. In fact, the place is as yet a vast Sahara of bareness, scarcely a single exhibit is in place, and the majority have not even arrived. Still, there is a small army of artisans and exhibitors hard at work, and a great change will doubtless be effected in a few days.

I inspected the Government and State building, and found it, like the main building, in an extreme state of déshabille. Many of the states, however, have valuable contributions already on the ground, and the chance of this building having its arrangements fully perfected at an early day is much better than that of the main building.

Each State is doing its best to make a good showing of its specialties, the Southern States generally exhibiting many varieties of fine timber and woods.

The room is lighted with the Brush arc lamp for the present.

I understand that the American Bell Telephone Co. exhibits, in connection with the U. S. Patent Office, the same historical exhibit of the various experimental telephones, showing the early stages of that remarkable instrument.

Speaking of telephones reminds me that I must not omit to state that a well-known telephone man, even Gen. C. H. Barney, of the New York & New Jersey Telephone Co., is connected with the Exposition as Commissioner from New Jersey, and is now in New Orleans.

Mr. T. D. Lockwood, of the American Bell Telephone Co., is also in the city on business of the company, and expects to remain here until about the 20th.

To return to the government building, which will be a most interesting feature of the Exposition, there is nothing in the gallery at present with the exception of a huge skeleton of something "very like a whale," a reproduced mammoth with long black fur, a pair of tusks eight feet long, and a trunk *à la* Jumbo; and a climbing skeleton of a megatherium, a megalosaurus or a mega volt, I don't know which, but he looks as if, when alive, he might have sufficient electromotive force to constitute the latter.

Explorer.

A New Electric Company.—The Underground Electric Company, for producing light, heat and power in the city of New York, has filed its certificate of incorporation. Capital stock $25,000; corporators, Joseph B. White and Henry Franz.

Cutting Down Operators' Salaries.

A special dispatch from the South says that the Western Union General Superintendent, J. Merrihew, is making a tour in the cause of economy on behalf of the company. In Mobile, Ala., he discharged one receiving clerk and reduced to just one-half the salary of the one retained; all operators were placed upon salary, and extra pay was abolished. The same sweeping measures, it is stated, were to be carried on in New Orleans.

Another special from Pittsburgh, dated Dec. 5, says: "The telegraphers of the country have about recovered from the blow they received by the disastrous ending of the great strike of 1882, and the probabilities are that within the next three months they will again try conclusions with the Western Union Telegraph Company. The encounter may not be in the form of a pitched battle, but the feeling is reported to be so intense among operators that no matter what is the character of their warfare it will be aggressive and bitter to the last degree. An operator of this city, a man of family and the owner of considerable property, gave a *Times* reporter an insight into the situation this evening. He said:

"'The telegraphers of the country have grievances as great now as those which brought about their strike two years ago. The rules in all the large offices have been made arbitrary to the last degree. Incompetent and objectionable men have been placed in charge as managers and chief operators in reward for their services during the strike, and in addition to that, there has been a systematic reduction of wages all over the country. The last statement, I expect, will be disputed, but I am prepared to prove it.

"'It is true that notices have not been posted in the various offices informing the employés that after a certain date their wages would be 10 or 20 per cent. less. A warning of that kind would have provoked a strike, and a safer but equally effective plan was adopted. Every day at some point in the country one or more men have been discharged, ostensibly because there was nothing for them to do or because of some alleged infraction of the rules. In nearly every case, however, the places have not been vacant twenty-four hours, and, without exception, the new men or old ones, when they are taken back, have been compelled to take the place at salaries from $5 to $15 per month less than were paid before the discharge.

"By this plan," continued the operator, "the company thinks it is cutting down expenses. There is no doubt that the earnings of the men are reduced, but telegraph operators are not fools, and, in the long run, they even up on the company by doing less work, and so cut down the saving by this underhand reduction to the minimum. But they are not satisfied. I never yet saw a man who was worth $90 per month content to work for $60, and telegraphers are not different from other people. They believe they have the remedy in their own hands, and are earnestly considering the propriety of applying it. Their organization as Knights of Labor collapsed with the strike, but in all cities beneficial societies, independent of each other, but working on a common plan, have been formed. These societies can be changed into aggressive unions with a membership of 10,000 under one head in a wonderfully short time. Only a year was required to organize in 1882, from Maine to California and from the Lakes to the Gulf. Now the same could be done in a week.

"If such an organization is formed I do not say that a strike will be ordered."

Still another special, from Philadelphia, says that operators in that city were non-committal in regard to the report that there would be another uprising, but one of the leaders in the late strike was found standing at the corner of Tenth and Chestnut with several of his colleagues. He admitted that another organization had been in existence for several months, which extended all over the country, and was already nearly as strong numerically as the old one. It is being conducted very quietly, owing to the fact that, after the late strike, all the men before returning to work had to sign a paper, promising never to join another like organization so long as they were in the company's employ.

He said that the new organization was complete and so worked that there could not possibly be any traitors in its ranks, and that 90 per cent. of the first-class operators in the country were members.

On the 7th inst. a special from Pittsburgh says: "The telegraph operators had a secret meeting this afternoon, to which no outsiders were admitted. Manager Williamson and Chief Operators Markle and Prescott were not there, from which it will be readily understood that the meeting was not composed of the members of the beneficial society. Those present were all men who figured more or less extensively in the first great strike. What subject was discussed or what action, if any, was taken can only be surmised. The invariable answer received to a request for information was that the public had no interest in the meeting, and it was not even important that the fact of its being held should be mentioned. There is not the slightest doubt, however, that the meeting was the first step in the direction of the formation of an organization, the requirement for which was outlined in the statement published on Saturday, or was in pursuance of steps that have already been taken."

Expired Patents on Magneto or Dynamo Electric Machines.—II.

BY F. B. BROCK, WASHINGTON, D. C.

The description of the following dynamos, taken together with those published in THE ELECTRICAL WORLD of Nov. 29, 1884, form a complete history of all this class of inventions patented in the United States which have expired and become public property. Their value to electrical specialists alone is, therefore, considerable.

Henry N. Baker, of Binghamton, N. Y., constructed an electro-magnetic machine in 1860, of which we give illustrations. Fig. 9 is a side elevation, partially in section, and Fig. 10 a transverse section of the Baker dynamos.

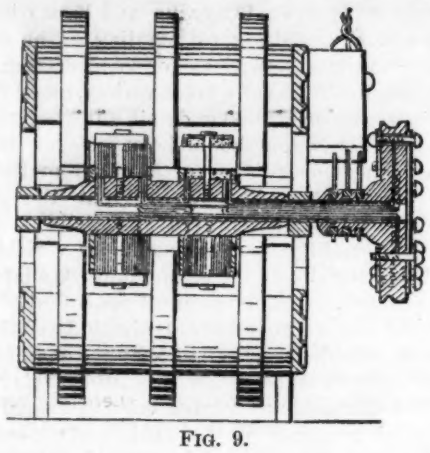


FIG. 9.

Fig. 11 represents a detail view of the "intensity-regulator," partially broken away.

In the Baker machine there are arranged three circles of stationary magnets, four in each circle. The driving shaft which carries the armature is horizontal, and passes through the centres of the circles of magnets. This armature consists of two wheel-sections, in each of which are twelve helices circumferentially arranged. The number of helices in each wheel section of the armature are in proportion to the number of poles in each stationary circle of magnets; are as three to two. The helices in the two armature wheels are arranged with reference to each other, so that the helices of one wheel are opposite to the spaces between the helices of the other wheel, and *vice versa*. The core of these helices is composed of two pieces of thin, flat, soft iron swaged in the centre to form a cavity for the reception of a screw-bolt, by which the helix is attached to the wheel. The screw-bolt secures the helix in its place in the armature by means of a metal cap applied to the outside, the bolt passing through the cap, as shown in Fig. 9.

The poles of the magnets are tapered, as shown, so as to make their edges parallel with the edges of the cores of the helices as the latter pass them in their revolution.

The "intensity-regulator" consists of a wheel of non-conducting material keyed to the armature shaft, and it may constitute the driving pulley. One set of the terminal wires forming the positive poles is connected with three arc-shaped conductors screwed to the side of this regulator, and those constituting the negative poles are connected with three inner arc-shaped conductors of the intensity-regulator. All the wires pass through the revolving armature shaft, which is made hollow for this purpose.

The wire connections with the arc-shaped conductors

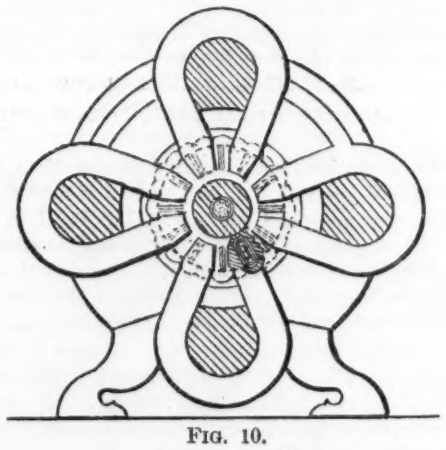


FIG. 10.

are made by connecting the terminal wires of each two corresponding helices in the two armatures in pairs before leading them through the hollow shaft to the regulator. This requires only twenty-four connections instead of forty-eight. When it is desired to produce a current of low intensity the screws shown on the intensity-regulator are screwed into the wheel in order to bring their heads into contact with the arc-shaped conducting plates. In this way all terminal wires from the helices are brought into direct communication with the pole-changer, producing the effect of connecting all the negative poles and all the positive poles. When it is desired to produce a current of high intensity the screws are all screwed out from the wheel to bring their heads clear of the arc shaped plates, whereby a connection is made between the negative terminal wires of the helices and positive terminal wires of their fellow helices.

Oct. 16, 1866, Auguste T. Berlioz, of Paris, constructed a magneto-electric machine having the general appearance of the one made by Baker. The armature discs revolve in the magnetic field between adjacent stationary circles composed of horseshoe magnets. Upon the main driving shaft is an insulated cylinder upon which are two rings which

FIG. 11.

constitute the commutator. The Berlioz machine is represented in Figs. 12 and 13.

To the frame of the machine is hinged an arm having a grooved roller pivoted in its outer end, as shown in Fig. 12. Against this roller bears a bow-spring secured to a flexible bar having an adjusting screw, which serves to hold the roller against one of the commutator rings. A similar device is applied to the other ring.

At the sides of the armature discs are insulated annular flanges which carry the helices. There are sixteen in each armature. Each helix consists of a core composed of two thicknesses of metal, it being split to prevent, it is said, the production of induced currents in the hollow core.

When a rotary motion is given the shaft the helices are revolved between the adjacent magnets, being alternately magnetized and demagnetized, and producing currents, first in one direction and then in another.

Different methods of connecting the helices are described in order to produce currents of varying intensity.

Before the date at which Berlioz constructed his machine it was generally considered necessary that the generated currents should flow in the same direction in order

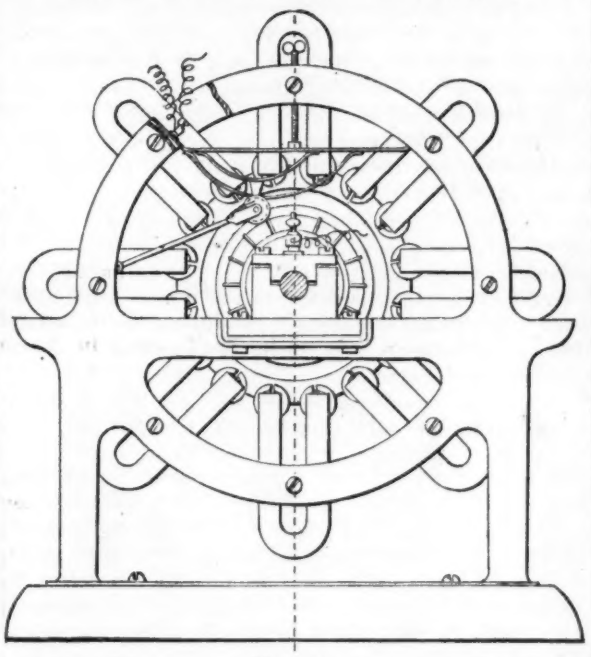


FIG. 12.

that they might be used for electric lighting purposes. M. Berlioz believed, however, that uncorrected currents might be more advantageously used, the currents passing first from one carbon electrode to the other and then back, so that the electrodes are consumed with equal rapidity.

The dynamo built by Henry Wilde, of Manchester, England, and patented in America (as was also the machine of Berlioz) Nov. 13, 1866, exhibits the first distinctive stationary electro-magnet, used in connection with a revolving armature.

The general appearance of the Edison dynamo resembles that of Wilde's machine.

Figs. 14, 15, 16 and 17 represent the construction of this

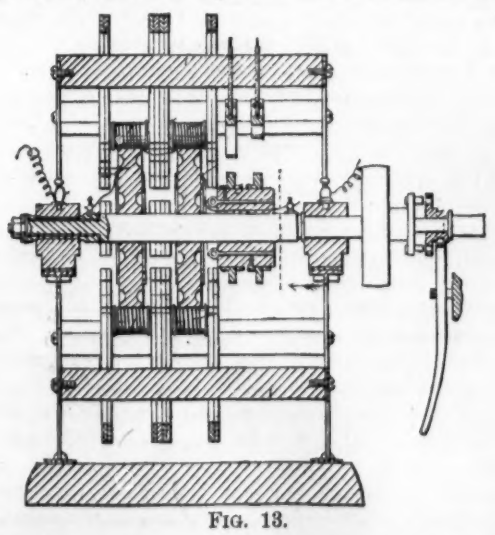


FIG. 13.

dynamo, the two latter figures being details of the armature.

This armature is made of cast-iron, turned parallel throughout its length, and about one-twentieth of an inch less in diameter than the hole in the magnet cylinder, in order that it may revolve in very close proximity to the interior of the cylinder. The wire upon the armature is wound in the direction of its length. Bands of wheel-brass encircle the armature, which is driven at about 1,800 revolutions per minute, generating two waves of electricity, moving in alternate directions during each revolution, as will be understood. The rapid successions of these alternating waves are taken from the machine as an intermittent current, moving in one direction only. This is accomplished by the spring-wipers, having proper electrical connections, shown in Figs. 14 and 15, which rub against the opposite sides of the commutator.

The commutator on the armature shaft is cut diagonally, in order that it may run more freely over the spring-

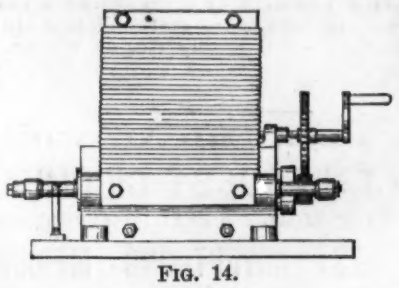


FIG. 14.

wipers bearing upon it. A short circuit is also made between the coils of the armature and the electro-magnet whenever the commutator is at the dead-point, or at that part of its revolution in which no electricity is generated.

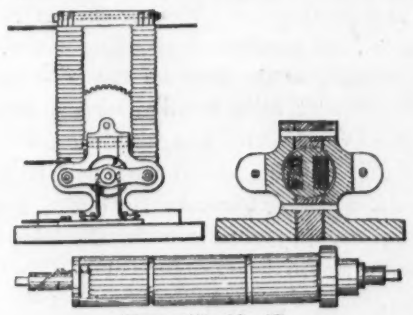
Fighting for Dear Life.

The English electric lighting companies have recently made a vigorous effort to obtain relief from some of the serious restrictions placed upon their legitimate operations by clumsy and stupid acts of Parliament. A London contemporary says:

We are glad to hear that immediate action is to be taken upon the suggestions of Mr. Chamberlain to the deputation reported in our last issue. It is considered very advisable that the suggestion made by the President of the Board of Trade, that the companies should submit, for the consideration of the Board of Trade, clauses embodying the desired modifications of the Act and Provisional Orders, should be acted upon without unnecessary loss of time, and a general opinion having been expressed that a committee consisting of representatives of the various electric lighting interests should be constituted to draw up such clauses and to confer with the Board of Trade, Lord Thurlow, as having introduced the deputation, has taken in hand the formation of an influential committee, which will be as representative as possible, and after having carefully considered the whole question will collectively submit the conclusions arrived at to the President of the Board of Trade. The Anglo-Brush Company is taking an active part in the formation of this committee, in continuation of its efforts toward the modification of the act.

An Improver of Animal Spirits.

"I recommend light as an improver of animal spirits," said Sidney Smith. "How is it possible to be happy with two mould candles, ill snuffed. You may be virtuous, and wise, and good, but two candles will not do for animal



FIGS. 15, 16, 17.

spirits. Every night, the room in which I sit is lighted up like a town after a great naval victory, and in this cereous galaxy, and with a blazing fire, it is scarcely possible to be low-spirited; a thousand pleasing images spring up in the mind, and I can see the little blue demons scampering off like parish boys pursued by the beadle." If a "cereous galaxy" could have such an effect upon the writer, what would he have said of a galaxy of incandescent lamps. It is true that the same inspiriting effect may be had by turning on all the available gas burners in the room, but for how long? The "little blue demons" which have scampered off at the sudden blaze of light presently return, the breathing of the occupant of the room is oppressed, his head feels heavy, the eyes smart and ache, and by and by the ultramarine ones of the long tails reign supreme. His last state is worst than the first. Incandescent lamps are the only true dispersers of blue devils, and may they—the lamps, not the last mentioned—soon be within the reach of every one.—*London World.*

THE GROSVENOR GALLERY WANTS THE LIGHT.—The management of the well-known Grosvenor Gallery, of London, give notice that tenders will be received for furnishing the complete plant necessary for the electric illuminations of the Gallery.

THE ELECTRICAL WORLD

PUBLISHED WEEKLY,

AT NO. 9 MURRAY STREET, NEW YORK.

Telephone Call: Murray 586. Cable Address: "Electrical," New York.

W. J. JOHNSTON, Editor and Publisher.
N. S. KEITH, Associate Editor, Scientific Department
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NEW YORK, DEC. 13, 1884

THE INCUBUS REMOVED.

The effects of the important decision rendered by Judge Wallace in the great telephone case continue to manifest themselves. It had long been evident that the lawsuit was a drag and an incubus upon the American Bell Company. The legal expenses attendant upon it were no inconsiderable item, and the Drawbaugh claims were presented with a shrewdness and plausibility that shook the confidence of even those most assured of the validity of the Bell patents. The price of the stock all last summer was remarkably low, the special reasons combining with general financial disasters to depress it; and many a telephone man felt very poor in consequence.

Now that the incubus has been removed, the whole prospect changes, and those who bought their stock at 150 or held on to it at that price, are materially enriched with the price at 250, and express corresponding elation. Moreover, at the meeting of the directors last week, an extra dividend of 3 per cent. and a regular quarterly dividend of 3 per cent. were voted. This makes 15 per cent. for the year, a rate that very few stocks have paid lately. The company are also seeking to recover the profits, costs, etc., due from the People's Company under the late decision. That is a natural step in the legal proceedings. The directors have, further, voted to petition the Massachusetts Legislature for authority to increase the capital from $10,000,000 to $20,000,000. The present capital stock outstanding is $9,602,000, and it is said that the new stock when created will be issued at par at the rate of $1,000,000 per annum. The control of larger capital would enable the company to extend its operations and to develop long-distance telephony on a profitable commercial basis. The experiments made by the company lately on the line between New York and Boston have been highly successful, and probably the time is near at hand when business men in cities widely apart will settle many of their daily affairs and transactions telephonically.

We hear good reports from all parts of the country in regard to telephone extension. As it is "darkest before dawn," the falling off last month in the output of the Bell telephones, preceding closely the favorable decision, marks the lowest point to be touched in the telephonic depression. Whatever may be the general outlook in other electrical fields, in telephony at least there is pronounced activity and hopefulness.

There is one point of interest, however, that should not be overlooked at this stage. The proposal to increase the capital stock of the parent company may awaken hostility, and the cry of "monopoly" will be raised with more vehemence than ever. The American Bell Company, in opening up the province of long-distance telephony, would need the money, as under its contracts with sub-companies it has reserved that work for itself; but this is a consideration not likely to hinder the attempt to impose some kind of burden on so rich a corporation, paying 15 per cent. on its present capital and with prospects of earning even more. The statement is made, by the way, that the wires between Boston and New York will be ready to lease by July next year. Between now and then busy hands and heads will work at the new problems presented for solution.

ELECTRICAL CONDUCTORS IN PARIS.

The importance attached in France to the installation of conductors for the distribution of currents of high electromotive force is seen in the decree issued by the president of the French Republic, creating a commission whose duty it shall be to fix the conditions with which all who use electrical currents must comply. The commission includes several eminent men, and has already drawn up a comprehensive programme, as follows: 1. To consider the precautions that should be taken when conductors are laid in the sewers or otherwise underground, above or along buildings, etc., and for their introduction and fixing within houses. 2. To prepare a list of conditions to be complied with on the part of contractors having charge of the installation of conductors intended for the transmission of power or light. 3. To ascertain the natures of wires, cables and methods of insulation which should be preferably employed in such installations. 4. To determine the resistance offered by the wires, according to their sections, to the passage of the current. 5. To fix the maximum current to be transmitted through conductors. 6. To recommend the best instruments for measuring the force of the current transmitted, and to determine a practical mode of control. 7. To suggest the necessary precautions to be taken by workmen when repairing conductors, so that they may not be exposed to danger. Evidently the French government is resolved upon protecting its subjects, just as its subjects are content to leave the matter to the government. We observe that precautions are to be considered for overhead wires, and infer thence that overhead wires have not yet had their day in France.

REPAIR OF THE COMMERCIAL CABLES.

The Commercial Cable Company were extremely unfortunate in having their cables broken so soon after laying. We are glad to note, therefore, that the southern cable has been repaired, and that the "Faraday" has proceeded to repair the northern cable. The break in the cable now spliced appears to have occurred in about 1,000 fathoms of water, about 560 miles from Canso, but no light, beyond these details, is thrown on the disaster. It is said that the great depth argues conclusively against the possibility of the break having been caused by a ship's anchor or an iceberg; and some credit is given to the supposition that a submarine landslip or an earthquake is responsible for the trouble. It would be highly interesting and valuable to know more about the manner in which "breaks" happen; but the knowledge seems hardly attainable at the present time. The Commercial cables are admittedly the best ever laid, but before the public could use them they have both been snapped by some mysterious submarine agency at a great depth. The broken Gould cables also lie in very deep water and will not, it is predicted, be repaired before the spring.

The Problems of Ship Lighting.

In the course of an able paper on "Electric Lighting for Steamships," read last month before the English Institution of Civil Engineers, Mr. Andrew Jamieson said:

In selecting a dynamo it was necessary to determine whether or not it fulfilled certain requirements: (1) It must develop electromotive force suitable for a certain lamp when driven at a certain definite speed. (2) It must be self-regulating; that was, the electromotive force generated at the given speed must remain constant to within 5 per cent., whether working one lamp or more, or the full number of lamps. It was preferable to have a slight fall in electromotive force as the number of lamps was reduced. (3) There must be no undue emission of sparks at the commutator brushes. (4) When running light, or with less than the full number of lamps, there must be no undue heating of any of the parts. (5) The conductivity of the copper wire with which it was wound must not be less than 96 per cent. of pure copper. (6) The insulation-resistance of the armature and electro-magnets should not be less than 10,000 ohms per volt generated at the required speed. The dynamo should be tested mechanically and electrically before being put on board ship, and afterwards, when fixed in position, by a final trial of not less than six hours' duration, with its own engine, and with all the lamps in circuit. There was considerable diversity of opinion regarding the limit of speed of a dynamo on board ship. As a consequence of the general desire for low speeds, most of the best forms of dynamos, the Siemens, the Edison, the Edison-Hopkinson, the Victoria, the Ferranti-Thomson, and the Pilsen-Schukert, had been specially modified for ship use, so as to produce the required electromotive force and current, at speeds varying from four hundred to six hundred and fifty revolutions per minute.

The success or failure of an installation on board ship depended as much upon the engine as upon the dynamo, and every care should be taken to procure one that needed the minimum of attention, and was not likely to break down. The engine should be capable of driving the dynamo during a voyage to Australia and back without a hitch and without requiring overhauling. The demand for such engines, more especially for those driving direct, had led to the production of a great variety, many of them excellent in workmanship and in detail. It was frequently necessary that the engine should be capable of doing its work when supplied with steam either from the main or from the donkey boilers, so that the electric light might be available in port as well as at sea. This entailed capability for working under variable pressures, and thus the size of the engine must be adapted for the lower pressure. One of the most important adjuncts to the engine was its governor. It should be sufficiently sensitive and reliable in action to keep the engine within 5 per cent. of its normal speed, with a load varying 90 per cent., and a boiler pressure varying 10 lbs. per square inch. No mechanical governor could do this, and consequently a good electrical governor, which would automatically open and close the throttle-valve, in perfect synchronism with the work, or load to be done, and leave the valve in its last position until the change was made either in the load or in the steam-pressure, was greatly to be desired. The author showed how this problem had been solved by means of his electrical governor.

Electric Lighting in Public Parks.

Mr. Ernest Hart, in a paper on the English Health Exhibition, read in London before the Society of Arts, observed that it was no small thing to have acquired the conviction that our open spaces may be, and should be, much more largely devoted to the open-air recreation of the people than they are at the present moment; and he continued: "Within an arrow's flight of the houses probably of most of us who are here there lie great open spaces, such as Hyde Park (but what I say refers also to Victoria Park), which at night are dreary, desolate areas of darkness, which are unlighted, which are dangerous to cross, which are unused in the evenings for any wholesome or moral purpose, which are often scenes for the display of some of the worst vices incidental to the lowest dregs of the population of the great city. Why should we not learn from the success of the music and the lighting of the gardens of the Health Exhibition that our great parks should all be lighted by the electric light at night and that throughout the spring and summer months the military bands should play there, and should make those places, which are now not only useless but scandals to the metropolis, the sites of healthful and innocent recreation. I have inquired from a good source what would be the cost of lighting Hyde Park by the electric light, and I am not speaking without data when I say that I believe Hyde Park could be adequately lighted with the electric light, so that it might add to the resources of health and enjoyment for the teeming population surrounding it, at an annual expenditure of about £5,000."

The American Electrical Exhibition, Boston.

The above exhibition in the building of the Mass. Charitable Mechanics' Association, was opened at 5:30 P. M. on the 8th inst. in an informal manner. Mr. P. H. Alexander, the general manager, made a few remarks stating the nature and objects of the exhibition. Capt. Nathan Appleton followed in a brief speech, in which he said that Mr. Alexander's hard work deserved recognition, and that Boston, as being the birthplace of Benjamin Franklin, ought to take special interest in an electrical exhibition. The attendance in the evening was large, in spite of the fact that the majority of the exhibits are still in an incomplete state at this time of writing, Dec. 11. The lighting includes already Edison, Weston and Arago lamps, and the telephonic, telegraphic and miscellaneous exhibits promise to be numerous.

SATURDAY NIGHT'S STORM.—The repair force of the wire lines in this section of country had plenty of work cut out for them by the storm which on Saturday night last swept and howled over this city and State, Pennsylvania, and near surroundings. The wind continued to blow at the rate of from 30 to 40 miles an hour all day Sunday, though the rain ceased at 12:50 A. M. of that date. The telegraph wires suffered; the W. U. lost several wires to Boston and had hard work to get business through with those remaining in condition. Many Western Pennsylvania wires were down and others worked badly, while crosses caused much delay. In this State the wires to the west gave considerable trouble and many places had to be reached by roundabout circuits, but repairs were promptly made. In Philadelphia, during the storm, it was impossible to get a message in or out of the city over the W. U. wires until 11 P. M.

Dynamo-Electric Machinery.*

BY PROF. GEORGE FORBES, M.A., F.R.S.E.

(*Continued from page* 227.)

Now let us see how all these principles, discovered by Faraday, can be applied to the construction of dynamo-electrical machines. You have seen, when I have a coil here with the north pole introduced through it, that there is then a current of electricity established in it, and that current is established only while the north pole is passing

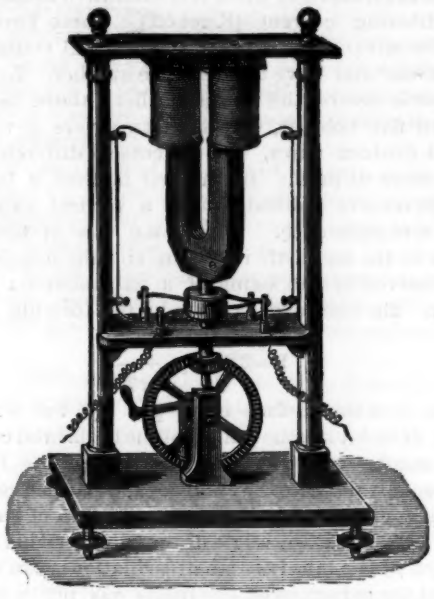


FIG. 6.—PIXII'S MACHINE.

through it. When the magnet is fixed no action is taking place. I have introduced the north pole into the coil, and if I withdraw that north pole by the way it went in, I shall, of course, create a current in the opposite direction. If, on the other hand, I carry the south pole in the same direction in which the north pole has gone, it also will create a current in the opposite direction. After I have passed the north pole through the coil, it is impossible to increase the current in that direction. The further motion of the other pole must produce a current in the opposite direction to the current first produced. However I may act in this way, I am bound to get a motion which gives alternate currents. If I use a bar of iron surrounded by a coil of wire and magnetize it, with the north at one end and the south at the other end I get a current, but it is impossible for me to keep that current going, because I cannot get beyond a certain amount of magnetization. If I reverse the magnetization I produce a current in the opposite direction at the moment of reversal.

It would seem then that we have the power of producing currents alternating in direction. This was the only type of machine known for a considerable time; and all of you have seen those instruments in which a handle was turned rapidly while a person held the ends of the wire in his hand and received a succession of severe shocks; that of Pixii or Saxton (Fig. 6). Here we have a horseshoe magnet fixed about an axis to which a rapid rotation can be given. At the top are two coils which remain fixed, and inside these coils there are bars of iron. The consequence of this is that when the magnet is rapidly rotated the north pole and the south pole will be successively presented to the coils, and the result is a continual reversal of the magnetism in those coils; and every time the magnetism is reversed a current is created in one direction or the other; and if the wires in these coils are held in the hand, a succession of violent shocks will be felt by the person holding them. One of the original machines of this type is shown in the historical collection in this exhibition.

I will put into the lantern another slide, showing a different form of machine. Here again is a horseshoe magnet. The magnet does not revolve, but the coils of wire revolve in front of the poles of the magnet. Here are the two coils at the bottom mounted upon a spindle which is horizontal. These two coils are rotated rapidly. Inside the coils are cores of iron. The cores of iron are magnetized in opposite directions as they pass from one pole of the fixed magnet to the other pole, and every time they do so, the current is changed in direction. Here also we are able to receive shocks from the coils by holding the ends of the wire in the hand. In this machine, as constructed, there was an arrangement for changing the direction of the current in the outer circuit at the same time that the magnetism was changed, but of that I will speak later.

In the next slide I shall show you the most practical of all the older machines (Fig. 7). This was the Alliance machine used for light-houses in Great Britain and France. It consists of a vast number of horseshoe magnets. This machine has actually been employed in our light-houses in France and England. At the present moment you may see a machine made by De Meritens which is exhibited by James W. Queen & Co. at the far end of this Exhibition, and which is constructed on the same principle.

A large number of rows of horseshoe magnets are about this central axis, around which also there is a ring of coils of wire each with iron inclosed, and all these coils pass in succession the poles of the magnets, and so alternate currents are created in the coils which produce a current of great intensity. These powerful currents are generated by means of a steam engine, and so we were able to get the powerful spark of the arc lamp like what was seen by Sir Humphrey Davy in 1811.

I may now pass on rapidly to the greatest improvement which was introduced, and that was the continuous current machine. It was found possible to take these currents from the machine which were alternately in opposite direction and reverse their direction through the circuit; that is to say, through an arc lamp or through the hands of the person holding the wires, and thus a continuous current always in the same direction was made. A single reversal, however, did not produce a steady current, and it was a long time afterward before means were devised for creating a steady current which was of real use in producing these continuous currents which we now use in electric lighting, and in this country in telegraphy.

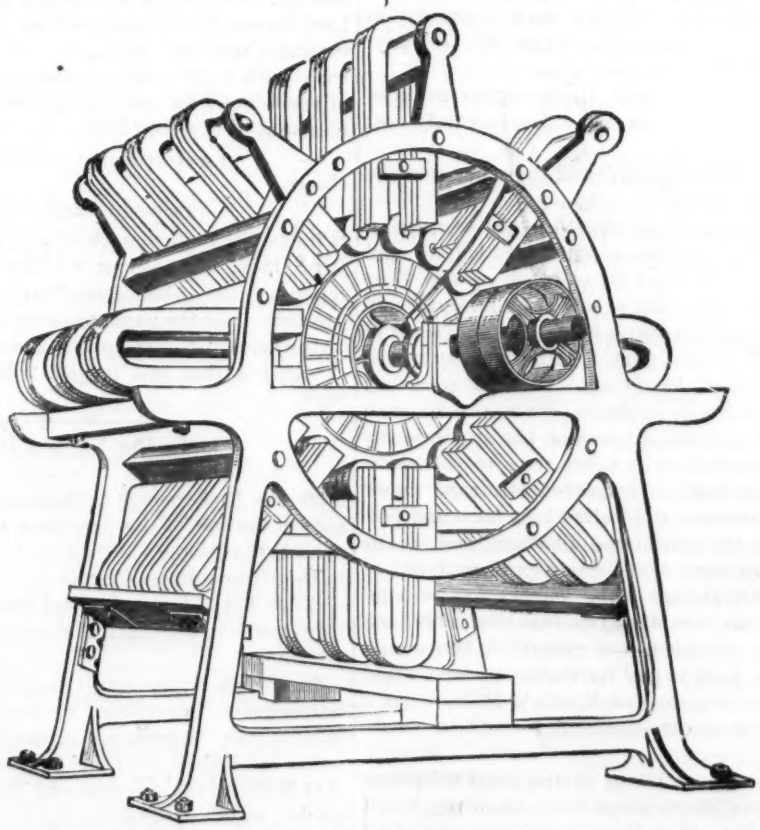


FIG. 7.—THE ALLIANCE MACHINE FOR ALTERNATE CURRENTS.

was due to the production of alternate currents by an arrangement which alternately magnetized and demagnetized the iron core inside the coil.

I will now show you some illustrations on the screen which show the construction of machines for producing alternate currents in this manner.

This is one of the alternate current machines, like that

The greatest improvement was introduced by Mr. Gramme about the year 1870, and he did this by means of a machine, a diagram of which you can see on the board here. This is only a rough diagram showing the principle of the machine. (Fig. 8.)

Here is the north pole of the field magnet, marked *N*, and here is the south pole marked *S*. These are magnetized by coils going around the mass of iron. Here is a ring of iron with coils of wire wound around it. This is the armature. The iron of the ring becomes magnetized by the influence of these north and south poles of the field magnet, and the poles in the ring retain the same position in space while the ring revolves. As soon as the ring rotates it follows that these wire coils are continually passing over the pole, or I might say this pole in the iron is continually passing through the coil. In other words an electric current is being continually developed through successive coils as they pass through here.

If you look at the sketch you will see that there is a south pole in the ring at *s* opposite to the north pole in the field magnet, and a north pole in the ring at *n* opposite to the south pole of the field magnet. If you remember the rule I have given you about the direction of currents you will be able to trace their direction in the machine. Sup-

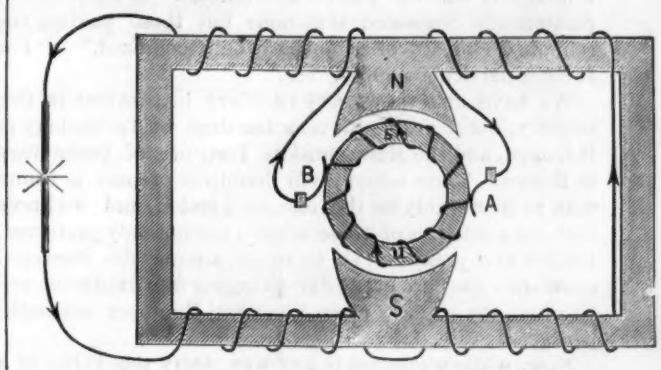


FIG. 7.—DIAGRAM OF GRAMME MACHINE (SERIES WOUND).

pose the ring to be revolving in the direction of the hands of a watch, the north pole will be going in the opposite direction through the coils, and if the eye be placed so that the north pole is coming towards it the induced current circulates with the hands of a watch; with a south pole the reverse takes place. Follow this out and you will see that the current flows in the upper semicircle from *A* through *s* to *B*, and in the lower one from *A* through *n* to *B*. But the wire is continuous, and if metallic brushes take up the current at *A* and *B* you see that the current will go out of the armature coils at *B*, through the circuit and in again at *A*.

Mr. Gramme constructed a commutator with a large number of bars to which the end coils were connected, and he used metal brushes to rub on them, and thus there was a continual series of changes going on as each coil passed those brushes, and thus he was enabled to get a very continuous current of electricity through his machine.

I have put up here a small diagram to illustrate the action of these commutators. (Fig. 9.) In the old alternate current machine there is a bobbin passing the poles of the magnet; the current increases to a maximum and falls to a minimum, then increases to a maximum in the opposite direction when there is no commutator employed. When we put in a single commutator so as to reverse the current in each pole it rises to a maximum and falls to a minimum, and we get this interrupted current, but always in the same direction. That was the first kind of continuous current made. Some machines were introduced to give a double commutation that is twice commutated in the course of a revolution, and thus an irregular sort of current was produced; but when Gramme introduced his machine with a vast number of commutations in one revolution he had a vast number of commutations and thus there is an almost continuous current produced by the Gramme machine.

In the Gramme machine which I showed you here the

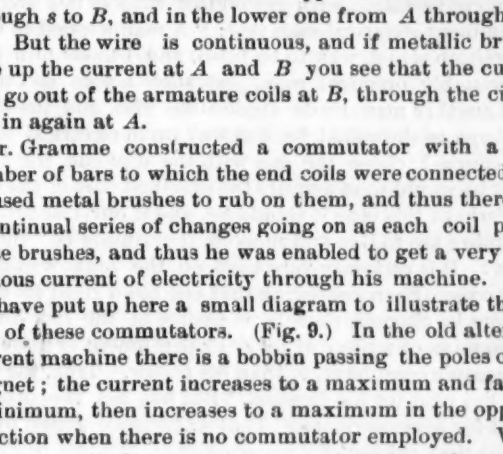


FIG. 9.—ACTION OF COMMUTATORS.

current itself is used to excite the magnetism in what are called the field magnets, and it passes through this field magnet before going to the lamp circuit. That is what is called winding the field magnets in series. Sometimes the current is taken direct from the revolving portion to the lamp circuit, and a second current is taken to the field magnets, forming two circuits, and thus the field magnets are said to be magnetized in a shunt. The practice of using the current which is induced to produce the magnetism of the field magnet was a completely new thing in 1866, and was invented simultaneously by several people, notably by Wheatstone and Siemens, who produced papers describing it on the same day in the Royal Society of London.

(TO BE CONTINUED.)

* A lecture delivered at the International Electrical Exhibition, Philadelphia, under the auspices of the Franklin Institute, on Sept. 16.

The Value of a Diploma.

To the Editor of The Electrical World:

SIR: I received the other day a circular of the School of Submarine Telegraphy and Electrical Engineering, London, England. For $375 the intelligent and industrious student can obtain in nine months the diploma of this school, which according to the testimony of such eminent men as Sir Wm. Thomson, Cromwell F. Varley, H. R. Kempe and others is of such value as to open the door to the highest positions in the ranks of Electrical Engineers. It guarantees positions to its graduates, and, as the demand for Electrical Engineers is so great, there is no doubt it can fulfill the obligations of such guarantee. It further states that "American companies can be supplied with thoroughly efficient and reliable officers. It is, however, particularly requested that none but those holding the school certificate of efficiency be recognized." "For further particulars apply," etc.

We have also some very excellent institutions in this country, notably the Stevens Institute of Technology at Hoboken, and the Massachusetts Institute of Technology at Boston. These schools will doubtless prepare a young man as thoroughly as the one in London, and we know that the graduates of these schools are not only preferred, but are at a premium, so to speak, among the electrical companies that are every day springing into existence, and to whom the services of an Electrical Engineer are indispensable.

Now, while we do not in any way decry the value of a diploma certifying the attainments of its owner and only wish we were the rightful possessor of one ourselves, yet we believe that this premium on "sheepskins" is in a measure unjust, when we consider that there are a large number of valuable men who are competent to fill these positions, but who, through the lack of a certificate, setting forth their attainments in electrical science are handicapped, as it were, in the race for positions.

In conversation with me on this subject last evening, a prominent electrical man said: "A man applied to me for a position which was to be filled, and I knew him to be a thoroughly practical man, just such a man as I needed, but another man made application also, and presented a diploma to show that he was way up in electrical science. Of course I chose the one with the diploma, for I knew that he would soon acquire the practical part of the work."

Perhaps this is as it should be, and if our institutions of learning are to live and succeed, it certainly is. But is it just? It is certainly very hard on the man without the diploma. Even conceding that one has a right to employ whom he chooses, there is no justice in the fact that the possession of a piece of paper or parchment entitles a man to greater consideration than his fellow. True, the graduate has paid for his diploma. But has not the other also paid for his experience? That experience generally costs more than tuition.

The London school above noted charges $375 and requires nine months attendance. Allowing $125 for books and sundries, which is a liberal amount, we have $500 and nine months time as the cost of the *Open sesame* to almost sure success. Once gain a footing such as a diploma would readily secure, and future success will depend solely upon merit, as it should; whereas to-day to gain the footing depends almost entirely upon the possession of a diploma.

In the case of the graduate whom my friend employed in preference to the practical man, because his diploma certified to his attainment in electrical science, and he would soon acquire the practical part of the work, we would ask where will he acquire this practical part? Where, and from whom if not from the practical man? Again, in the case of this practical man whom my friend rejected, who is to say without suitable examination that he was not as well up in electrical science as he of the electrical school, possessing the diploma? Recent developments of electrical industries have set men to studying this science, and hundreds of hard workers in electrical trades are investing every spare dollar in books and apparatus wherewith to fit themselves for greater usefulness, and thereby to better their condition. Are these men to be entirely cut off from all possibility of success for the lack of suitable recognition? It ought not to be so. The man who by diligence and study attains a certain proficiency in the theory and practice of a given science, no matter under what circumstances, is entitled to the same recognition as he who obtains the diploma of the schools. It is well known that he does not get it as a rule, nor is it likely that he ever will under the existing order of things.

But is there no remedy? It seems to me that there can be, and I suggest the following for the consideration of some of our well disposed "electric lights" if I may so call them. There is not one of them but will readily cross the ocean in one of the trans-Atlantic steamers, and will trust his life and the lives of his family to the skill and care of the captain and other officers in charge of the vessel; and yet not one of those navigators has received his certificate of efficiency in seamanship, or navigation, from a given school, but from a Board of Examiners. Nor did any one of them receive his certificate till he had served a period as seaman and gave practical proof of his ability to perform the work which he professed to understand; not experimentally in a school, but practically, at sea; in the capacity of sailor at first, and from that, step by step, to the highest position. Surely such a certificate means something, and is valuable, not simply as evidence but as proof of efficiency.

Now where is the objection to such a course for electricians? Why not a Board of Examiners in electricity who shall issue a certificate to the applicant, having passed a rigid examination in all branches in electrical work, theoretical and practical? What objection can be offered to such a plan?

Such a certificate would be doubly valuable if granted by a board of examiners chosen from among the electricians actively engaged in the practice of their profession. Such a system would be beneficial both to employé and employer. To the one it offers the possibility of advancement beyond the common drudgery of the workshop, and to the other the certainty of obtaining well-trained electricians who have served a thorough apprenticeship in all branches of the work, and can be relied on in emergencies wherein the school-trained man would be at sea.

Such a course need be no more expensive than is within the means of most young men. A fee for the certificate, to cover the expense of engrossing it or preparing it, and a reasonable payment for the services of the examiner, is all. Will not some of our electricians do something in this direction, and give those a chance upon whom they very largely rely for the success of their enterprises?

ELIZABETH, N. J., Dec. 3, 1884. H. B. SLATER.

Telephoning Music in 1876-77.

To the Editor of The Electrical World

SIR: In reading over Judge Wallace's decision published in your enterprising journal of 6th inst., I was strongly reminded of a side show to the Exhibition of Professor Elisha Gray's Harmonic-Electric piano, which created so much interest in Chicago in 1876-77. It will be remembered that Prof. Gray reproduced over wires between Chicago and Detroit, Milwaukee and Chicago and other cities, some simple airs such as "Robin Adair," but the tones were sadly wanting in quality although the pitch of the notes was correct, and they sounded more like bumble bees seeking to escape from the inside of an inverted glass goblet. To remedy these imperfections and keep alive public interest, a prominent Western electrician of the W. U. T. Co., shortly after Prof. Gray commenced his exhibitions, removed from a box relay the magnets, substituting therefor a small music-box, having a range of three airs after being wound up. False pole pieces protruded through the box of the relay facing the armature, the adjusting screw was in its usual place, and binding posts on the base, and there was nothing on the surface to create a suspicion in the uninitiated that the relay was other than an ordinary box relay. After his usual morning devotions this electrician would carefully wind up the concealed music-box, place the box relay innocently on the testing shelf in his laboratory and then quietly await his victims. Then a scene like this would follow: The W. U. Superintendent, showing Secretary of State Harlow, of Illinois, and others around, would drop into the electrician's lair. Introductions follow; then conversation upon the telephonic and harmonic events of the day. Finally the electrician would inquire thus:

"By the way, have you heard of the latest invention of Gray?" Answered by all in concert, "No, certainly not; what is it?"

"Why it transmits all the qualities of the tones over the wire, only somewhat subdued in loudness."

At this point an illustration is offered to the wondering and expectant visitors. Cincinnati office is called up and the chief operator there is asked to connect up the New Gray Harmonic Telephone. (These calls, of course, merely go through the speaking tube from the electrician's lair to the next room, "calling Cincinnati" being merely a ruse to enhance the chances of deception). In a few moments it is announced that all is in readiness, wires are connected to the box relay and by a slight touch of the finger on the armature (which is connected by a fine wire to the starting lever of the music box) the improved electrical music from Cincinnati commences to produce long faces and protruding eyes among the bewildered listeners, and words are wanting to record some of the many exclamations.

Almost every electrical man in the country will remember how cleverly he has been duped by this box relay, and when the secret was revealed, how cheerfully he contributed a nickel to the fund to pay for the music box. Had these witnesses been denizens of Eberly's Mills, what a nice case of priority in electro-harmonics could be established!

Coming to a more serious phase of the great telephone suit, would it not have strengthened the Drawbaugh side to have set up the claim that Drawbaugh was a clairvoyant and had all his telephonic ideas communicated to him while in a trance? J.

NEW YORK CITY, Dec. 8, 1884.

THE POSTAL TELEGRAPH BILL.—A special from Washington states that Representative Morey has informed the House Committee on Post Offices and Post Roads that he has information from the Senate which leads him to believe that if the House passes the bill to secure cheaper telegraphic correspondence, the Senate will accept it as a substitute for the Postal Telegraph bill now pending before it.

Determination of the Ohm.

In response to the desire of the International Commission on electrical units, MM. Mascart, De Nerville and Benoit have, says *Engineering*, made a series of experiments to determine the resistance of a column of mercury at zero temperature, representing the practical unit of electrical resistance, or, as it is called, the ohm. The absolute resistance of a conducting circuit has been measured by the current induced in it when displaced on the terrestrial magnetic field (Weber), or when it is submitted to the action of a neighboring current (Kirchoff). These two methods have the advantage of presenting several common characteristics, and serve to check one another. To eliminate systematic errors, the commissioners above named constructed five bobbins, of which two were covered with several distinct wires, and seventeen different combinations were utilized. In the first method a frame was made to revolve suddenly round a vertical axis through half a circumference. The frame was at first perpendicular to the magnetic meridian, and the impulse current was observed by the swing of a galvanometer needle in circuit. The resistance is given by the formula

$$R = 2S\frac{H}{h}.g.\frac{\pi}{r\theta}$$

Where S is the surface enveloped by the wire of the frame, H and h are the values of the horizontal component of the magnetic field at the points where the frame and balistic galvanometer were placed; g is the constant of the galvanometer, that is to say, the action of unit current on the needle; θ is the angle of impulse or swing; r is the duration of the infinitely small oscillations. In the second method the induction on the frame was produced by the inversion of a neighboring current. Calling I the inducing current, M the coefficient of mutual induction of the circuits, the resistance of the induced circuit is

$$R = 2M\frac{Ig}{h}\frac{r}{\pi\theta}$$

where the other letters mean the same as above. The apparatus was installed in the Pavilion Francais in the park of the Trianon, which the Minister of Public Instruction and Fine Arts placed at the disposal of the Commission. More than fifty complete series of observations were made, each occupying from two and a half to three hours. The resistance of the circuit was compared each time with that of a standard B. A. unit; the general mean came out

1 B. A. unit = 0.9861 ohm.

To evaluate this resistance with the column of mercury, four tubes of 1 square millimetre in sectional area were prepared and chosen of a length which gave them, when filled with mercury, sensibly the same resistance as the B. A. standard. Each was carefully calibrated at the International Bureau of Weights and Measures, and filled with mercury in a vacuum, then compared with the B. A. unit at the ordinary temperature, and in melting ice. Experiment, however, showed that filling in air did not appreciably affect the electric resistance nor the weights relative to calibration. Correction for the end resistances was made by Lord Rayleigh's formula, which was directly verified by cutting a tube into several sections, connected together by vases with large openings, and determining the variation of resistance produced by each section. Very concordant measures of the four tubes give the result that

1 mercurial unit = 0.95374 B. A. unit.

Hence

1 mercurial unit = 0.9405 ohm.

It follows that the length of a column of mercury at zero Centigrade, and 1 square millimetre sectional area, which represents the value of an ohm, is 1063.3 millimetres. At the same time the commissioners from an attentive study of the results, and in applying some extra corrections, are of opinion that the length 1063 is perhaps a little too high.

To the Victors the Spoils.

Messrs. Dickerson & Dickerson, solicitors for complainants in the suit of the American Bell Telephone Company against the People's Telephone Company, recently argued in the United States Circuit Court, before Judge Wallace, and decided in favor of complainant, entered an interlocutory decree in the office of the clerk of that court, on the 6th inst.

This decree states that it is ordered by the court that the letters patent granted to Alexander Graham Bell for an improvement in telegraphy, dated March 7, 1876, and one dated January 30, 1877, are good and valid in law. It says that Bell was the original and first inventor of the telephone, and that the defendants have infringed the patents named. It is ordered that the complainants recover from the defendants all profits and advantages which they have received or made by reason of their infringement. The costs and disbursements of the suit are also to be paid by the defendants.

Judge Wallace proceeds to appoint John A. Shields, Master of the Court to take and report an account of the gains, etc., which the defendants have received, to the Court, since the 22d day of June, 1880.

This duty will occupy many days, and the sum involved will be considerable.

Telephonic Induction and the Amplification of Telephonic Sounds.

BY EDWARD P. THOMPSON, M. E.

There are various directions in which inventors and investigators are endeavoring to overcome induced currents in telephone wires and to amplify the vibration of the atmosphere at the mouth of the telephone receiver. The directions worked in and the direction in which they hope for success are apparently the following, as far as preventing induction is concerned :

1. In the generation of the current, it may be possible to so produce the current that it will be of such a nature that other currents will have no effect upon it, or else the effect will be of such a nature as not to interfere with the current carrying the speech.

2. In the transmission of the current, experimenters seek to so construct the conductors or to surround them with such a protection as will prevent currents from being induced in the wire carrying the speech.

3. In the receiver. This may offer an opportunity to apply such improvements as will, as it were, sift out the induced currents from the current carrying the sonorous vibrations.

4. In the combination of the generation, transmission and reception of the current carrying the sonorous vibration, it may be possible to construct a system so that, as a whole, the evils of induction may either be prevented or overcome.

Having pointed out the places in the system where the results of induction are to be overcome or prevented, the next step consists naturally in considering to some extent the nature of induction, and how it takes place in a wire. To get at the inmost nature of induction, it is only necessary to state that a conductor is, more properly, simply a guide for the current of electricity; for whatever the electricity may be, it does not all travel in the wire, but it also travels upon the surface and in an unlimited space surrounding the wire.

When the electromotive force is very intense, as in statical electricity, the current is not known to exist in or influence the material of the conductor, but is found only upon the surface and in the space surrounding the same. Perhaps if the E. M. F. were infinite, the current would not even be found upon the surface, but in a concentric layer of space or atmosphere about the conductor. On the other hand, when the E. M. F. is very low, the current exists almost entirely in the body of the conductor. A conductor, in the strict sense of the word, and as used for the transmission of the electric current, is a metallic wire and the surrounding space. It follows, therefore, that if there are two parallel, or nearly parallel, wires, one of which is connected up with a source of electricity, then the second, being in the surrounding space, will assist in conducting the current—*i. e.*, will be possessed of an induced current, or, if both wires have currents produced in them by generators of electricity, then will these two currents influence each other by assisting to conduct each other's current. If one is stronger than the other, each will add to the strength of the other. If they are in opposite directions, they will tend to neutralize each other. If one is in a state of vibration—*i. e.*, if one is carrying a current of variable amount or electromotive force, the other will be influenced similarly.

By reviewing several late inventions of electrical conductors for preventing induction, the object sought seems to be the removal of the current from the space surrounding the conductors. Say there are three parallel circuits lying in an imaginary plane. Let No. 1 be charged with a current; the inventors believe and claim to have proved that wire No. 2 will take up all the current in the surrounding space so that there will be no induced current in the farther wire, No. 3.

Wire No. 2 thereby is alleged to protect No. 3. In order to increase this alleged useful effect, wire No. 2 is placed very near No. 3 (which may be supposed to be the telephone wire), and is in some cases coiled about the same. In another type of improvements of this idea, two or more circuit wires are coiled about each other. In other improvements a band or tape of metal replaces wire No. 2 and is so coiled and overlapped as to form a pipe or shell, and in some cases ordinary lead or other metallic pipe is employed not only to prevent induction, but to protect the conductor from atmospheric and accidental or miscellaneous injury.

That wire No. 2 protects from induction in No. 3 is false, as far as all principles of induction go to show; but it is true that it *assists* in preventing it, for a metallic circuit contains several times as much electrical energy as all the surrounding space; *i. e.*, it grasps all the lines of force and concentrates them much nearer to its axis. Wire No. 2 therefore weakens the electrical field of force about No. 3, and if coiled it brings more conducting metal into the same space and thereby concentrates still further the electricity into a smaller space; but such a wire can never entirely prevent the induction, for it is itself surrounded by an electrical field on account of the current induced in it; it being understood that the nature of an induced current and of a secondary, etc., induced current is the same as the primary or any other induced current.

When wire No. 2 becomes a coil surrounding the wire to be protected, there is another increase of efficiency and an increase which is by no means small, and is due not only to more wire brought into the same space, but also to the fact that the current in the coil is not flowing parallel but approximately at right angles to the current in No. 3.

Mr. Alexander Welsh, of Rahway, N. J., undertakes to prevent induction and to provide general protection to the wires by the use of means which are improvements upon the methods just pointed out.

The invention consists essentially of a tube, through which the naked wire passes, and which is made of a combination of two or more concentric tubes, one or more of which are metal and one or more of which are any suitable insulating substance, such as paper, tar, rubber, etc., or any of the new insulating substances, such as okonite, kerite, etc. These tubes are made in sections of any convenient length, such as 10 feet, and the invention consists also in means of joining these sections into one continuous length, and of joining them for any purpose whatever. By the application of linseed oil, air spaces are prevented from existing in the substance, such as pitch, tar, etc., in which the protected conductors are buried for actual use in telegraphy, telephony, electric lighting, etc. In all these inventions wire No. 2 is supposed to be well grounded at both ends.

One of the best means which have been found up to the present time to avoid the loss and bad effects by induction, consists in providing each series of stations with two wires, the one to go and the other to return, the two wires being superposed in such a manner that every exterior action exerted upon either corresponds with an equal action in a contrary direction exerted upon the other.

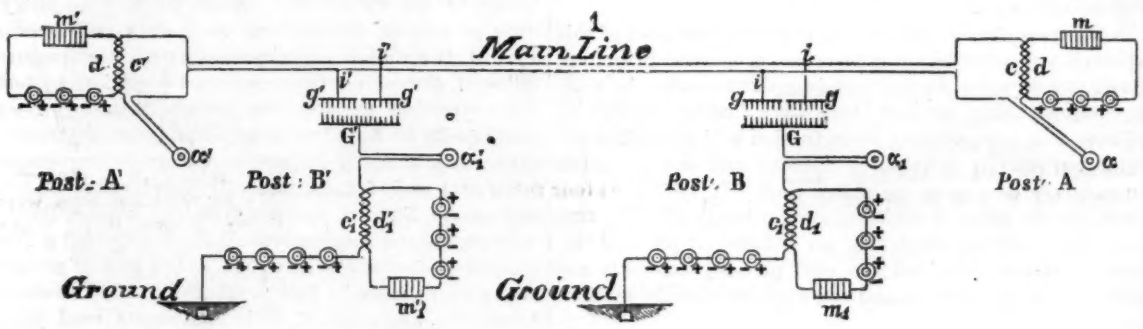


FIG 1.

From an industrial point of view, this solution has only the inconvenience of increasing slightly the price of the extra length of conducting wire; but the other expenses of installation of the line are not any more increased than if only one line were used.

Nevertheless, in a technical point of view, there is a double installation, and it seems probable, *à priori*, that this increase of sacrifice becomes compensated for by the efficiency of the system. It is intended, therefore, to examine here whether there could not be installed in a parallel circuit four stations conjugated two by two, the pairs being made independent of each other. When there is a circuit completely insulated there could be disposed, at first, those differences of potential which exist at each instant between the different points; then the absolute value of the potential at any of the points.

In that which follows we shall confine ourselves to the study of practical dispositions in particular, and we shall content ourselves to solve two questions which appear interesting to us.

1. Being given a telephone circuit comprising a wire going and returning upon itself, to install in this circuit four telephonic stations conjugated two by two, completely independent from one another.

The solution of the problem becomes evident.

The apparatus of the first two stations react, the one upon the other, in producing currents of induction upon the line. These currents would be produced whatever the mean absolute potential might be along the line.

A method of theoretical realization of this conception has lately been proposed by M. Leblanc in *La Lumière Electrique*, and is represented in Fig. 1.

The stations or posts A and A' are conjugated in the same manner as B and B'.

The main line is completely insulated. It includes the two telephone receivers a and a', of the stations A and A', plus the resistance circuits c and c' of two induction coils. m and m' are two microphones comprising the inductors d and d' of the circuits c and c'.

The above constitutes an ordinary telephonic installation, which permits of conversation between the stations A and A'.

Let the two points $i\,i$ and $i'i'$ be considered. While a current of induction traverses the line there is established a certain difference of potentials between the points $i\,i$; but the charge of the line remaining constant, the average potential does not vary. The result is that the total charge of two plates g and g in relation with the two points $i\,i$ will not vary, and that, in consequence, if one consider the large plate G installed opposite the two plates g and g, the influence of the currents of induction which circulate through the line will cause the electrical distribution upon the surface to vary, but not the total charge. Therefore, there will be established a determinate current in the circuit which connects G with the ground.

It will be the same for the points $i'i'$ and the plates $g'g'$ and G'.

Now, if by any exterior action the charge of the plate G becomes increased—for example, in speaking to the microphone m, there will be a current of electricity through the points G upon the plates $g\ g$; the potential being raised by the same quantity at the points $i\,i$, there will result a current of induction in the lines. Only two electric waves or vibrations are propagated parallel in the two wires. They may be toward the two points $i'\,i'$, or they may increase the charge of the plates $g'\,g'$. There will be a flow of electricity from $g'\,g'$ through G'; then from G' toward the earth across from the telephone, which will repeat in B' the words pronounced before the microphone m of the station B.

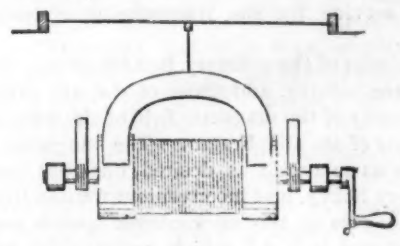


FIG. 2.

It is thus apparent that the stations A and A', B and B', allow conversation between them in an entirely independent manner. The problem heretofore proposed is therefore solved.

2. Different methods for permitting the amplification of the sound emitted by the telephone.

In the assemblage of apparatus which constitute a telephonic installation, the following may be named :

I. An apparatus which has for its end the measuring, at each instant, the pressure of the surrounding atmosphere—a pressure which varies at each instant in consequence of the impulses communicated to the air by sonorous vibrations.

Under the influence of these variations of pressure, this first apparatus endures vibrations which are themselves rigorously proportional.

These vibrations will have for their result the following different cases:

1. The development of an electromotive force.
2. A variation produced in the pre-existing electromotive force.
3. A variation of the resistance of the circuit.
4. A variation of the capacity of the condenser.

II. A line carrying a continuous current (of which the intensity is of scarcely any force), the function of the first apparatus having for its object the production of a variable intensity.

III. An apparatus called the receiver, which will be charged to make vibrations corresponding to the variations of the intensity of the current. The surface will communicate its vibrations to the surrounding air.

The result is that the vibrations which are produced upon the receiver are identical with the primitive sonorous vibrations. A proposition is offered that the intensity of the sound emitted might be equal to if not greater than that produced upon the transmitter.

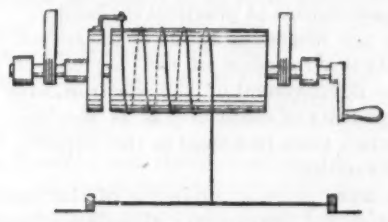


FIG. 3.

This object could be attained by means of three general methods proposed by M. Leblanc, and could besides be employed simultaneously, and which correspond to cases where it might be desired to use them, either at the primary station, or along the line, or at the receiver.

First case: It is necessary, in order that the transmission may be clear, that the distortion or vibration of the first apparatus may be at each instant proportional to the pressure exerted upon it. This requires that the distortions may be extremely small, in order that there may be a development of rapidly acting forces. It follows that the variations of the electromotive force, of resistance, etc., will be equally very small, a condition necessary in order that the proportionality may be preserved.

These very small variations may, therefore, without sensible error, be treated as differentials, according to M.

Leblanc. Let I represent the intensity or current, R the resistance and E the electromotive force, then

$$E = R\,I$$

in which,

$$dI = \frac{dE}{R} - \frac{Id\,R}{R}$$

$$dI = \frac{dE}{R} - \frac{Ed\,R}{R^2}$$

It is to be remarked that if R does not vary, that is, if $dR = O$, the variation of intensity $d\,I$ is independent of E, that is of the sum of the electromotive forces, constant or inactive, upon the telephone which is included in the telephone circuit.

This explains how it becomes possible without inconvenience, as M. Van Rysselbergh has accomplished it, to establish telephonic communications through conductors already serving for the transmission of telegraphic dispatches.

In the case of the ordinary Bell telephone, the variations of $d\,R$ are nothing, and those of $d\,E$ are proportional to the intensity of the magnetic field of the telephone and the vibrations of its diaphragm. The magnetic field could be made as energetic as desired, but that leads to apparatus very heavy, and inconvenient for handling.

In the case of the microphonic speech maker, $d\,E$ is constant, and it is $d\,R$ which varies. The result is, that

$$dI = \frac{E}{R^2}\,dR.$$

The total resistance enters into the denominator as a square. It is, therefore, necessary to render it as feeble as possible. Also the line should be divided into two parts, the one to include the microphone, the galvanic cell and the large wire of the induction coil; the other the line proper, the fine wire of the coil and the telephone receiver; all at a change of value which necessarily costs something.

Further, in the primary circuit of the microphonic installation a resistance remains, especially in the presence of the cell, and it is impossible to reduce it sufficiently, even with cells of large capacity.

In effect, the phenomenon of the production of current is accompanied by quick modifications in the state of the electrodes, which, acting either upon the electromotive force or upon the resistance, determine the insupportable hissing in the telephone as soon as the intensity becomes a little increased.

It is thought, therefore, that with a given microphone (it is generally recognized that all the elements of the different forms of apparatus present a resistance as feeble as possible), in order to have variations $d\,I$ as large as possible, it is preferable to obtain the electromotive force not from a cell but from a little motor, which would make E very feeble, it is true, but R incomparably very small.

Now as a machine of a continuous current of this kind may be complicated, it is interesting to be able to replace it by an electromotor for alternate currents such as that of M. Abdank Abakanowicz, in which a fine wire is substituted by a large one. This presents no inconvenience, for the period of oscillation is too long in order that the changes of the direction of the current could produce a less intensity of sound.

M. Leblanc cites for this proposition the following experience, which is the result of several years. He has a galvanometer of the Deprez type interpolated in the circuit of the fine wire intended to measure the electromotive forces of a telephone, and in the circuit of large wire a microphone without a cell.

When a fish bone was agitated to stop the needles of the galvanometer, there was heard a sound in the telephone, and if one spoke at the same time before the microphone, the telephone repeated the speech as well as if the system had been set up in the ordinary manner with a cell in the circuit of the microphone.

This experiment shows clearly that the solution indicated is susceptible of practical realization

In the case where the action of the speech determines at each instant a variation of the capacity of a condenser, there is a development of the electromotive force due to such a quantity of electricity as is necessary for a potential as much more increased as the capacity which it possesses is smaller.

There being given a conductor of the capacity C, and a variation $d\,C$ of this capacity, there is produced a current of electricity $d\,Q$ proportional to the potential of the condenser.

It is necessary then that the latter also be increased as much as possible, and further that there should be room to replace the cells which serve to maintain this potential at a constant level by a little machine. But it is necessary to give it, contrary to the preceding case, an enormous resistance, or to substitute for it an equalization of potentials.

Second case. Having produced in the line variations as large as possible, it is now proposed to amplify them along the line.

The method will be very simple. Let the line still be divided into two parts. The first part includes the inductor of a little dynamo-electric generator; the second, its armature. If the latter turns rapidly, the variation of intensity, which, in the second portion of the line, will be proportional to the first multiplied by a certain coefficient proportional to the rapidity of rotation of the armature, will become amplified. Now let it be remarked, that it is useless to make two distinct separations, and that it will suffice to put a large wire around the inductors which are interpolated in the circuit of the microphone.

Third case. The variations $d\,I$, more and more amplified, are transmitted to the receiving apparatus and there determine the vibrations. Let it now be proposed to reinforce their action upon the surrounding atmosphere.

Mr. Edison has given a solution of this problem in his electro-motograph.

There is also another solution, which consists in making an apparatus from a reed. The latter was soldered to the plate of the telephone receiver, and when the apparatus was traversed by the current of air, the intensity of the sounds depended not only upon the amplitude of the movements of the reed, but also upon the rapidity of the current.

There are still two processes derived from that of Mr. Edison and which perhaps could be made to give good results.

Replacing the cylinder of chalk by a cylindrical electro-magnet (Fig. 2), upon the extremities of which is carried an armature in the form of a fork, the middle of this fork being attached to the telephone plate; then, if the electro-magnet is turned, the adhesion of the fork upon its extremities will vary with $d\,I$; the plate will then be more or less attracted; and the necessary work will be furnished by the rotation of the electro-magnet.

This multiplication could be made larger by rolling upon the little wheel a flexible wire, of which one of the extremities will command the movements of the telephone plate, and the other will be fixed to a disc of iron mounted upon the axle of the wheel (Fig. 3).

If the latter include an electro-magnetic influence $d\,I$, the disc will tend to be more or less attracted, and in consequence of the rotation, a proportional effort, but multiplied in a relation as large as is desired, will be communicated to the prong soldered to the telephone plate.

The two subjects named at the beginning of this article have been treated of jointly for the reason that improvements in either direction will be equivalent to an improvement in both; for if the sonorous vibrations at the receiver are increased, the effects of induction will not be noticeable; or if induction or the effects of induction are removed, then it will not be necessary to make the sound as loud as otherwise.

In the remarks upon induction in the former part of this article, it was assumed that the causes or general principles were known by the reader, but in order to make the matter comprehensive, none of those were directly alluded to.

There is a case wherein no induction will take place between currents or between a current and one or more wires. This case may be stated thus: in two or more wires, one or more of which convey primary electric currents, there will be absolutely no induced or partially induced currents, provided the said primary currents are mathematically constant and the wires are strictly motionless.

This seems to be true, as far as experiment proves, but it may be discovered at a future date, when more delicate means of detecting inductive effects have been devised and careful research has been carried on, that induction does take place in spite of the fulfillment of the above conditions, under a change of temperature of the wires, whether such changes occur by the current itself or by some exterior source. To fulfill all these conditions of constant current, constant rest and possibly constant temperature of the wires, is practically impossible, although installations made to conform to such requirements would assist in preventing the bad effects in telephony. The wires should be stretched as tightly as possible and the posts should be very near together, the currents should come from effective electric generators, etc. These precautions are only slightly helpful; for in the telegraphic circuit, the current varies when a message is being transmitted. When the key is depressed a current is generated, and grows rapidly from an intensity of zero to its full strength. This increasing of the current produces an induced current in an adjacent wire. In the same manner, the breaking of the circuit produces a decreasing current, and so generates a second induced current in the adjacent wire or wires.

In the same manner the making and breaking of the current of any circuit produces an induced current in surrounding wires. Electric arc circuits do the same on account of the variation of current produced by the variation of resistance at the arc. Also, in the system of incandescent lighting, the turning on and off of lights produces variations of currents, and therefore induced currents.

These variable induced currents react indefinitely upon one another to produce secondary, tertiary, etc., currents. Telephonic circuits react on telephonic circuits on account of vibrations of the current. The jarring of houses, the movement of the wires by wind, by work performed on them by linemen, etc., produce induced currents on account of the motion of the currents in the wires. Lastly, these variable currents themselves set the wires in motion on account of their alternately increased and decreased attractions or repulsions or both for one another.

The Nomenclature of Electricity.

The discussion in regard to new terms, units, etc., necessary or considered so, by a portion of the scientific circle specially interested in electricity, is growing wider and warmer. To present the views of our cousins over the water, we give below an article from the London *Mechanical World*, our only comment upon it being that we think that the paper exerts its sarcasm rather too vigorously in regard to the esteemed gentleman referred to as "a most prominent English electrician."

Better evidence of the soundness of the position we have taken up, against the absurd and unscientific nomenclature favored by a few gentlemen whose knowledge of physics is limited, could not be afforded than that which is provided for us by the New York ELECTRICAL WORLD, in a verbatim report of the recent National Conference of Electricians. Among the speakers was a most prominent English electrician who instructed his audience in this wise: "In a sperm candle, for one candle light we expend 97 watts . . . with gas. for every candle given out 62 watts were consumed." It says much for the politeness of our cousins that they suppressed their smiles. Evidently the speaker has a most confused idea of the "watt" which apparently may be expended or consumed like gunpowder, and yet the watt is a unit with which he should be as familiar as with the inch or pound. It is rather bad form to explain a joke, but rather than the gem should be unappreciated we will try to make it obvious. The "watt" is defined as the electric unit of power or rate of doing work when one ampère passes through one ohm. Its common sense and ordinary name is the "volt-ampère," and substituting for this the "given" name, we are told that when we burn a candle we "expend" 97 volt-ampères, and infer that the process of combustion gives somewhere or somehow an available electromotive force of say 32.3 volts, with a current of three ampères, and the novel result follows that the candle has a resistance of 10.7 ohms! This discovery, like other important discoveries, promises revolutionary applications. In incandescent lamps an available E.M.F. of 32.3 volts and a current of three ampères would give about 30 candles light, and thus by joining up, say ten candles in parallel circuit, we might possibly keep three or four lamps of 30 ohms resistance aglow, and so, without engines or dynamos, get four times more light than the candles would give in their native sconces. When a leading electrician and F. R. S. indicates so plainly that he does not understand the nature of the units whose names he uses so glibly, it is time to protest, as we have done over and over again, against the absurd practice into which electricians have fallen of disgracing their departed superiors by fastening their surnames to quantities for which descriptive names could easily be found. Why should not chemists adopt the same practice if it possessed a single argument in its favor and call, for example, diphenylamine, Dalton; benzophenone, Bunsen, and phenylthienylketone, Davy? Or, why should not mechanics call the foot-pound a Tredgold, the pound-degree a Whitworth, or the unit of pressure and area a Stephenson? This is precisely what the electricians have done, and some of their statements read just as absurdly as would "one hundred Stephensons will burst a boiler;" or, "if we oxidize a Roscoe we produce a Cavendish;" or, "a vessel of the Smithic capacity will hold one thousand Joneses."

An Electric Railroad Underground.

For about two years past there has been in successful operation in the Zankerode Colliery, at Plauen, Germany, an underground electric railway which carries its cars loaded with coal over a level road of some seven hundred feet in length, making twenty-five trips per day, and speeding at the rate of seven miles an hour. Its daily carriage amounts to about 200 tons. The entire plant has cost nearly $4,500, there has been no outlay for repairs, and the wages of two employés constitute almost the total expense, so it is an economic as well as a mechanical success. The details of operation we gather from the account of a visitor to the mine. There is above ground at the colliery a dynamo, which is driven by belting from a small vertical engine placed with the cylinders inverted, the pulleys being about 3 to 1. The dynamo and engine are run at respectively 600 and 200 revolutions per minute. The shaft of the pit is 720 feet deep, and down it, by ¼ inch copper wire, is transmitted the electricity, and in the road it is led along two rails like a T-iron secured to the roof of the mine.

The road has a double line of rails in it and is arched with brick throughout its length, the conductors being fastened to porcelain insulators fixed in the masonry. On the locomotive and connected by gearing to its wheels is a dynamo, each of whose poles communicates with one of the conductors on the roof by means of a covered wire, one end of which is fastened to a carriage running on the rail and the other to a pole of the dynamo. When the dynamo on the surface is driven the current passes down the shaft by one of the wires and along the conductor until it reaches the carriage; then down the wire to the pole of the dynamo on the locomotive, and in passing through the dynamo to get to the other pole, and thence to the return, causes the armature to revolve, and the motion is communicated by gearing to the wheels of the locomotive. The proportion of useful effect in the arrangement is thus given: Steam-engine, 10 h. p.; dynamo, 5 h. p; locomotive, 3 h. p., demonstrating that 30 per cent. of the power of the steam-engine is got out of the locomotive. The whole affair is simple, compact and effective and the results are perfectly satisfactory to the owners.

The Frisbie Patent Friction Clutch at the Electrical Exhibition.

Among the new and reliable appliances for transmitting and controlling power, the patent friction clutch of Messrs. D. Frisbie & Co., No. 481 North Fifth street, Philadelphia, has earned a well-deserved reputation and been accorded prominent position. The points of superiority which are claimed for it have been established by its successful employment for several years in many large establishments throughout the country. These advantages consist in its adaptability for every kind of work, however heavy or light, and for all grades of speed. It can be gauged to carry any weight or force, from a few pounds to tons, and works at the set limit under all circumstances, until a different adjus ment is made, which can be easily effected while the machinery or machine is in motion, without the aid of tools, and by the most inexperienced employé. With this attachment steam can be connected with water power without ch ck or damage to shafting or machinery, as the connection is made gradually and the wheel and engine are made to work in perfect harmony without stoppage of either. The same control and gui lance is exerted in starting and stopping all machines irregularly used, also in factories or mills where certain portions of the work demand more power and speed than others; all the delays and danger incident to such irregularities are entirely obviated by placing this clutch between the power or force and the machine or work.

In hoisting machines, pile-drivers, rubber and paper calendering rolls, brass and iron rolling mills, testing machines, wire-drawing, bolt-heading and nut machinery, heavy punching and shearing presses, and an endless variety of work, where delay, trouble, accident and expense is frequent from breakage or straining, the clutch attachment has time and again proved its efficiency and great value.

At the late electrical exhibition in Philadelphia the Frisbie invention was extensively employed, it being especially adapted to dynamo electric machines permitting of the stopping or starting of any dynamo in the system without reference to any other. The durability of the attachment is well attested by three years' service in many places, and during that time the firm manufacturing the friction clutch have fitted up a number of complete electric stations and also furnished the friction pulleys for the Chicago and St. Louis, general and sub post-offices, the Rhode Island Electric Light Co., Providence, R. I.; the U. S. Illuminating Co., New York; the U. S. Electric Light and Power Co., Philadelphia, Pa.; the U. S. post-office, Philadelphia, Pa., and many other plants.

We present two cuts illustrative of the application of the friction clutch, which will be readily understood by the practical and all interested parties; Figs. 1 and 2.

By screwing the nuts upon the bolts as represented, the lever cams are pressed with greater and greater force upon a conical c llar fixed upon the shaft to be connected.

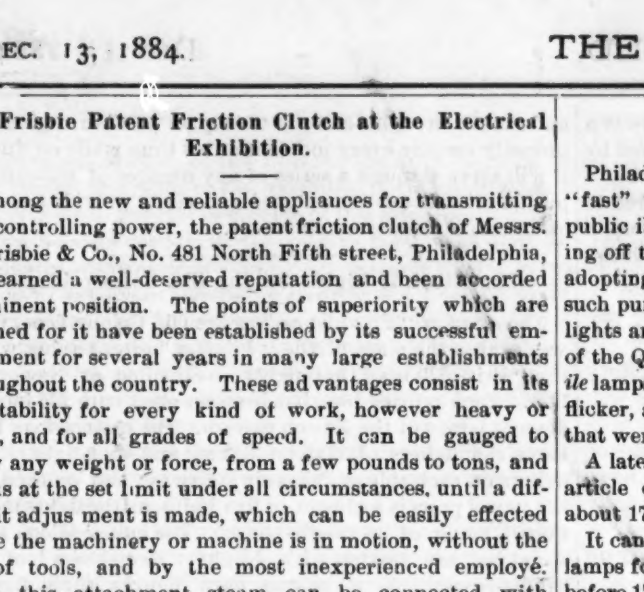


FIG. 1.

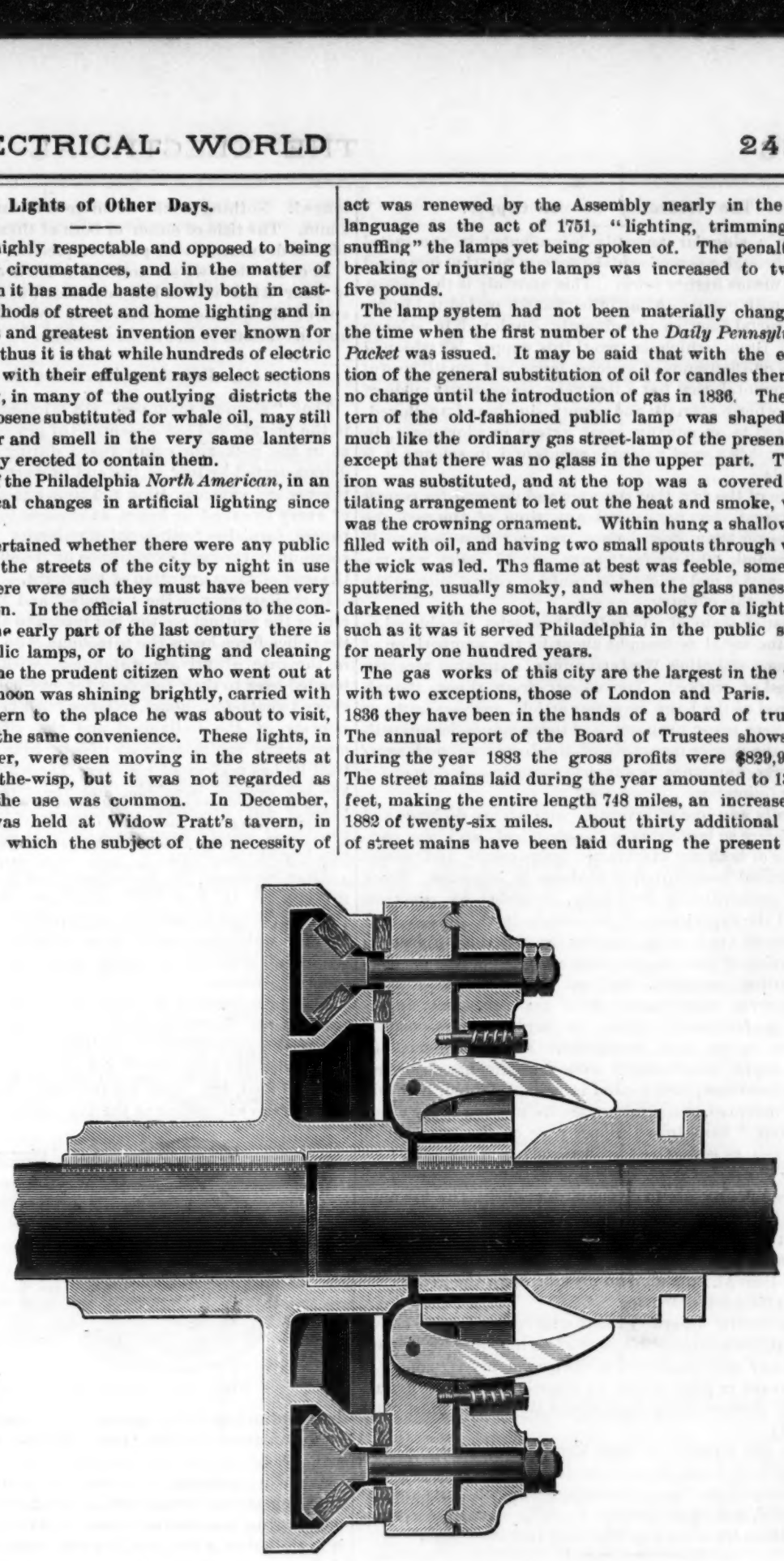


FIG. 2.

TO BE CALLED FOR BY ELECTRICITY.—The most potent, grave and reverend Senators of these United States will, in addition to being button-holed by their constituents, be button-called by irrepressible electricity in the future. The Senate Chamber has been fitted with electric calls, communicating with the committee and other rooms of the building, and Senators can and will be summoned to their desks when occasion requires their presence, in the same manner in which a waiter is called om the hotel office to a room. Lightning is a great leveler.

The Lights of Other Days.

Philadelphia is highly respectable and opposed to being "fast" under any circumstances, and in the matter of public illumination it has made haste slowly both in casting off the old methods of street and home lighting and in adopting the latest and greatest invention ever known for such purpose; and thus it is that while hundreds of electric lights are flooding with their effulgent rays select sections of the Quaker City, in many of the outlying districts the *ile* lamps, with kerosene substituted for whale oil, may still flicker, and sputter and smell in the very same lanterns that were originally erected to contain them.

A late number of the Philadelphia *North American*, in an article on the local changes in artificial lighting since about 1749, says:

It cannot be ascertained whether there were any public lamps for lighting the streets of the city by night in use before 1749. If there were such they must have been very few and far between. In the official instructions to the constables issued in the early part of the last century there is no allusion to public lamps, or to lighting and cleaning them. At that time the prudent citizen who went out at night, unless the moon was shining brightly, carried with him a lighted lantern to the place he was about to visit, and brought back the same convenience. These lights, in good or bad weather, were seen moving in the streets at night like will-'o-the-wisp, but it was not regarded as peculiar, because the use was common. In December, 1749, a meeting was held at Widow Pratt's tavern, in Market street, at which the subject of the necessity of public lamps was considered. Whether it was believed that the City Corporation was without authority to do this, or was indisposed to undertake the expense, does not appear. The parties who attended agreed to place lamps in front of their own doors and to pay the expense of having them regularly lighted and attended to. The example had its effect, and even excited the slow-going Assembly to action.

The act of 1751, before referred to, not only concerned the well ordering and regulating of the watch, but "the enlighting the streets, lanes and alleys in the night time within the city of Philadelphia" The wardens were ordered to maintain and preserve and take care of the lamps "already erected"—by citizens it is presumed, bnt not so expressed—"and to erect, put up and fix any additional number of lamps in such parts and places of the said city as to them shall seem meet and expedient, and to contract with any person or persons for the lighting, trimming, snuffing, maintaining and repairing of them." From this it would seem that candles were expected to be used in the lamps, which would require continual trimming and snuffing. Whale oil partially, if not entirely, superseded the candles in subsequent years, as is apparent by references to the storage of oil in connection with the duties of the wardens.

In order to preserve the lamps, penalties were denounced against persons who should maliciously break, throw down or extinguish them, or damage any of the posts, irons or sentry (watch) boxes. The penalty for breach of the ordinance was forty shillings. But if any servant or negro slave was guilty it was ordered that he should be "whipt on the bare back with twenty-one lashes at the public whipping post, and kept on bread and water at hard labor in the public workhouse three days." For a subsequent attempt the punishment was thirty one lashes and imprisonment for six days. In 1771 the watch and lighting act was renewed by the Assembly nearly in the same language as the act of 1751, "lighting, trimming and snuffing" the lamps yet being spoken of. The penalty for breaking or injuring the lamps was increased to twenty five pounds.

The lamp system had not been materially changed at the time when the first number of the *Daily Pennsylvania Packet* was issued. It may be said that with the exception of the general substitution of oil for candles there was no change until the introduction of gas in 1836. The lantern of the old-fashioned public lamp was shaped very much like the ordinary gas street-lamp of the present day, except that there was no glass in the upper part. Tinned iron was substituted, and at the top was a covered ventilating arrangement to let out the heat and smoke, which was the crowning ornament. Within hung a shallow dish filled with oil, and having two small spouts through which the wick was led. The flame at best was feeble, sometimes sputtering, usually smoky, and when the glass panes were darkened with the soot, hardly an apology for a light. But such as it was it served Philadelphia in the public streets for nearly one hundred years.

The gas works of this city are the largest in the world with two exceptions, those of London and Paris. Since 1836 they have been in the hands of a board of trustees. The annual report of the Board of Trustees shows that during the year 1883 the gross profits were $829,991.07. The street mains laid during the year amounted to 136,606 feet, making the entire length 748 miles, an increase over 1882 of twenty-six miles. About thirty additional miles of street mains have been laid during the present year. The total number of services laid is 103,014, an increase over 1882 of 2,159.

The quantity of gas manufactured during the year 1883 at the several works under the management of the Trust was as follows: Twenty-sixth ward works, 782,453,000 cubic feet; Ninth ward works, 962,964,000 cubic feet; Fifteenth ward works, 186,635,000 cubic feet; Twenty-first ward works, 40,252,000 cubic feet; Twenty-fifth ward works, 473,064,000 cubic feet; total, 2,445,368,000 cubic feet. This was an increase over 1882 of 125,470,000 cubic feet. The amount of gas made at all the works managed under the Trust in twenty-three previous years was 3,678,362,400 cubic feet.

To discuss here the vast stride in advance of candles, oil and gas, made by the electric light, and its advantages in every single particular would be a work of supererogation; every reader of THE ELECTRICAL WORLD can supply all that is needed to make the comparison, and the most ignorant mortal, having eyes, can see the shining superiority of the light to-day, as well as the field for its greater use in Philadelphia.

PEDESTRIAN PHILOSOPHY.—By means of the odograph in experimenting and studying the march of French soldiers, M. Marey, the eminent French physiologist, has demonstrated: That low heels have a very favorable influence on the pace at which a person walks; that the rhythm of the step has an important influence on the speed. The rhythm was studied by means of an electric bell, actuated by a pendulum of variable length, to enable the subject to keep exact time, and the distance traveled was recorded on the odograph by electric signals sent along a wire at every 50 metres traversed. It was found that the length of the step increases little until 65 steps per minute are taken, it then increases until 75, and afterwards decreases as a higher rhythm is reached. The speed of travel increases with the acceleration of the rhythm up to 85 steps per minute, and decreases at higher rhythms.

The Widening Use of Copper.

Rather a singular anomaly is presented in the metal market through a reversion of the general rule that increased demand means higher price. This anomaly is the case at present, with copper. At no other known period in history has this metal been so prominently employed in science and art. Brass, which is two-thirds copper, is fashioned into tens of thousands of articles large and small, useful and ornamental, that but a few years since were made of wood or other materials; and copper, simple and unalloyed, is employed to an equally great extent in adornment, in chemistry it is a most valunble agent, and in science it is invaluable.

In spite of the fact that the uses and demand for copper at the present time far exceed any time of the past, the price is lower than ever before, ranging now around 13 cents a pound, while a few years ago 19 cents was the average, and it had reached 50 cents a pound during the late war in this country.

This happy state of affairs for those who are obliged to employ the metal is brought about by the competition of the Arizona and other Western mines, somewhat recently discovered or worked. The copper from these, though not so good as the Lake Superior article, answers quite as well for very many purposes, and the supply is inexhaustible, and the copper monopoly of the Lake can no longer, as formerly, announce in advance the price of copper for the year following.

In hardly any line of invention and science do brass and copper figure so largely as in the electrical, and the consumption of both for machinery, instruments and necessary practical prosecution of business is immense. Since the best authorities in electricity, seconded by practical tests and the experience of thousands have proven that copper wires are in some respects far superior to iron in transmission of current, for telegraph, telephone or electric lighting purposes, its use is becoming universal wherever new aerial lines are run, and opportunity is frequently taken to replace with copper the iron wires now employed. In consequence of this the copper wire trade in some departments enjoys an unusual briskness; new capital is being invested, new machinery invented, and rival houses are making every effort to turn out "hard-drawn copper wire of the strength of steel," such as is required by electricians. Tons upon tons of every variety of wire, a few months since unknown, are kept in stock and are in constant demand. The lowness of price in the raw material makes a vast difference in the cost of the manufactured article, and in the saving the public indirectly benefit through the lessened outlay necessary for lines and plants, and also through the greatly increased efficiency of service.

To the electric fraternity the matter comes directly home, the scientist is as susceptible to matters touching his pocket-book as any other man, and as the present cry is "copper!" any increase in price would be regarded as a misfortune, while its further cheapening would be viewed most complacently.

In the last number of THE ELECTRICAL WORLD and in several recent issues we have treated at length and given prominence to the discussion of copper wire and its alleged superiority, and these articles so fully cover the ground that to them we refer any who may feel interested.

The Legal Effect of the Wallace Decision.

A circular has been issued by Mr. C. F. Livermore, President of the Molecular Telephone Company, giving the opinion of Messrs. W. H. Peckham, W. S. Knox and A. Q. Keasbey on the decision by Judge Wallace in the Bell-Drawbaugh case. The opinion reads as follows:

In reply to yours of 4th inst. we would say that, in our opinion, the decision of Judge Wallace only affects the single defense set up by your company, among many others, of the inventions of Daniel Drawbaugh, which were set up by way of anticipation of Bell's patent. Indeed, Judge Wallace says that by the pleadings and arguments of counsel, practically the question for him to decide was whether Bell or Drawbaugh was the original inventor of the telephone and the principle involved in its operation. It seems to have been conceded in the case that either Bell or Drawbaugh was the original inventor of the telephone in the broad sense. Such a concession is, in our opinion, fatal to a fair trial or comprehensive decision of the merits of Bell's alleged invention and the validity of his patent.

Your company rely, by way of anticipation, upon prior discoveries and inventions, which are proved, with a single exception, by publications and contemporaneous printed documents.

There was no defence of non-infringement made in the Drawbaugh case, an important question in your case, neither does Bell's patent of 1876 seem to have been seriously attacked in what seems to us its manifestly vulnerable points, and Judge Wallace devotes but a trifling space to its consideration and adopts the construction of the Circuit Court in Massachusetts in cases where there was the same want of vigorous attack, and where there was also the same fatal concession of Bell's title to the invention of the telephone.

It seems also from the language of Judge Wallace's decision that it was also conceded that Bell or Drawbaugh was the discoverer of the undulatory current, and that it was the contention to which of them that discovery belonged. Nothing could be more unfounded than such a claim. The title of either or both of them is disproved by official documents that put that question beyond doubt.

In conclusion, we see nothing in the decision referred to in your letter which has any effect, as a decision, upon any of the questions involved in the alleged discoveries and inventions of Daniel Drawbaugh.

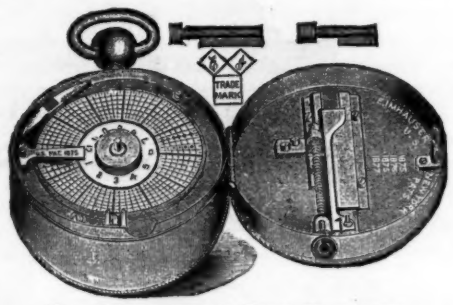
Detecting the Detective.

That "sleeping upon post" is a criminal neglect of duty in the private and public sentinel of peaceful times as well as in the picket or camp guard during war, has been demonstrated by loss of life and property, through fire or thieves and violence, time and time again; and the news of every twenty-four hours, as brought to us by the daily papers, furnishes fresh proof of calamity to individual or community through carelessness or dereliction of duty on the part of some guardian of the night.

In military service the "reliefs" and "Grand Rounds" render the sentinel on the *qui vive*, and the roundsman in the police force keeps the patrolman "on the jump." But in the case of private watchmen, with vast properties handed over to their sole care for one-half or one-third of every twenty-four hours, reliance must be placed upon the honesty of the individual and the efficiency of such mechanical appliances as will bear him out in affirming that he has performed his duty. The watchmen, however, are not always infallible, and the "registers" of their tours of duty are, many of them, liable to irregularity or capable of being "fixed" by a cunning hand until they lie like any human being.

An invention of Mr. E. Imhauser, of No. 212 Broadway, this city (P. O. Box 2375), called the Watchman's Time Detector, seems to meet the requirements of a watchman over the watchman, and to be a perfectly honest tell-tale of the night's work of the party whose every movement it indelibly records.

The accompanying cut will give a general idea of the instrument. In the old style of mechanical watch-clocks the marking apparatus is unreliable, confusing, easily tampered with and susceptible of damage and disarrangement through dust, etc. With the Imhauser Detector the watchman carries his "officer of the day" with him. The watch is



THE WATCHMAN'S TIME DETECTOR.

delivered to him (when going on duty each evening) wound up to run about sixty-five hours, and in it is a fresh paper dial. A safety-lock attachment (an important recent improvement) prevents all "outside intervention," and attempting to "fix" or tampering with the recording cards is indicated by a special provision. The marking arrangement is in the cover of the case, the watch movement being entirely separate and closed against dust or any foreign substance.

At each of the different stations of the watchman's beat he finds a different key secured. This he inserts through the key-hole and turns it around to the right once, thus causing a figure to be punched on the dial at the minute the hand on the watch indicates. The person receiving the "detector" from the watchman, after his tour of duty is performed, unlocks the instrument, and upon the dial reads each minute's work of the entire night, of fidelity or recreancy on the part of the trusted employé.

To enlarge upon the necessities for such indicators of duty fully performed is unnecessary. The large class of interested parties have too much at stake not to be keenly anxious to insure the faithful discharge of services so vitally important. That the invention of Mr. Imhausr has been appreciated is proven by his reference to many of the wholesale and retail establishments of New York, manufactories, banks, armories, hotels, hospitals, breweries, clubs, theatres, steamship lines, express offices, as well as several electrical and electric lighting concerns, now using his invention.

The patents of the Time Detector are dated Nov. 30, 1875; Jan. 25, 1876; Dec. 5, 1876; June 26, 1877; Sept. 28, 1880; Aug. 30, 1881; March 18, 1882, and each date that marks the issue of a new patent means improvement. The estimation in which the invention is held by experts is exemplified by the medals awarded it, including the highest award and medal of honor at the Centennial Exposition, 1876, for portability, security and general adaptation to the purposes intended; in 1876, '77, '78 medals for excellence and superiority, at the American Institute; in 1881, award at the Cotton Exposition, Atlanta, Ga., and in 1883, at the National Exposition for Railway Appliances at Chicago, the only medal for the most complete and perfect instrument.

The cost connected with this safeguard is a trifle compared with its value—not averaging over two cents a night—as the instrument will last the lifetime of a watchman, and should any who carry it "sleep on post" or neglect to properly employ every moment of his time while on duty, it will serve through a series of any number of watchmen until a reliable one is employed and safety provided as far as human ingenuity can insure it.

The Electric Lights on the Old Colony Line.

The steamer "Providence," of the Old Colony Line, this week takes the place of the "Pilgrim," after having with the "Bristol" been thoroughly overhauled at Newport, R. I. Each refitted boat has been supplied with 675 incandescent lamps of the Edison pattern. The main saloon has three chandeliers of sixteen lights, and six 6-light chandeliers on each side of the main stairway; and on each of the newel posts is a cluster of five bulbs, all the lights mentioned being of 16 candle-power. The ladies' saloon and social hall are lighted with 4-light "electroliers" of 10 candle-power. Four unique harp figures, three lights each, with colored shades representing morning glories, the electric bulb being the flower, are on the quarter-deck of each boat. The vestibule, at the foot of the stairway leading to the grand saloon from the quarter-deck, is lighted by two 3-light electroliers. The main deck, or freight space, is lighted with 31 bulbs, especially designed for the boat. Two electroliers of three lights each illuminate the engine room, and twenty-four 2-light brackets, every one of different design, light the gangways of the main saloons. In the dynamo rooms are four dynamos of the T type, which are the latest of Mr. Edison's inventions. They are capable of running all the lamps, and are connected in what is known as the multiple arc. In case of accident, the engineer can easily throw the disabled one out of the circuit entirely, and run the lights with the remaining three without decreasing their intensity. Two specially built engines of the Armington & Sims manufacture drive the dynamos. The engine is exclusively adopted by the Edison company for steamboat use, and each has a capacity of transmitting 75 horse-power; special boilers provide steam for the engine at the discretion of the engineer in charge. In the dynamo room is a regulator, on which may be seen two dials. When two machines are running, the intensity of the light is either increased or decreased, according to the number of lamps required on the circuit at one time by the first regulator. When the third and fourth are thrown in circuit, the intensity of the current is regulated by the second regulator. The switch-board in the dynamo room has 18 circuits, which include the entire system for each boat. In case of accident to any of the circuits, a safety wire on the switch-board will fuse and throw the disabled circuit out of circuit immediately, and, in the mean time, does not interfere with any of the other circuits. Every saloon is supplied with a suitable locker, from which are connected all the smaller circuits, and by the electrician in charge, at pleasure. A new feature is the application of the light in the boat's signals. Each signal, port and starboard, consists of two 32 candle-power lamps, only one of which burns in each at a time. A relay magnet is provided, and this serves to throw the reserve lamp into circuit in case the carbon of the first one breaks, thus insuring a permanent light. The watchman, in his rounds, upon discovering that the first lamp is broken, reports it to the electrician, who will immediately replace with a new one for future contingencies. The lights on the bow and stern are arranged substantially in the same manner. The system for both boats cost $40,000.

One of the New Cables Repaired.

The splice in the broken Bennett-Mackay cable was completed on the 6th inst., and at 2 P. M. that day the executive office of the Commercial Cable Company, at No. 2 Nassau street, was in communication with Ireland. General Manager George G. Ward stated that the steamer "Faraday" found the fracture in from 900 to 1,000 fathoms of water, about 560 miles from Canso, Nova Scotia. The finding and repairing of the break was more prompt than the officers of the company expected, and it is now believed that the new ocean telegraph will be in complete readiness for business in a short time. One of the first messages sent over the cable was one of congratulation to John W. Mackay, who has already reached Europe.

THE TELEGRAPH CONFERENCE AT ST. PETERSBURG.—The English General Post-office authorities have officially denied all intention of proposing at the approaching international Telegraph Conference, to be held in St. Petersburg, Russia, any restrictions with regard to the regulations applicable to telegraph code messages, and declare that no reduction in the number of letters allowed as the length of a code word was in contemplation, and further, that if such alteration is proposed by any other administration, England would strongly oppose its adoption.

THE ARLBERG TUNNEL TELEGRAPHIC CABLE.—There was lately laid, in the Arlberg Tunnel, Europe, a telegraphic cable of twelve strands, six of which the government reserves for its own use; three are entirely devoted to railroad service and the remaining three alone are reserved for eventualities. Each strand is formed of seven copper wires, twisted and inclosed in gutta percha, and the covering of all consists of tarred hemp and eighteen galvanized iron wires twisted, round which is rolled a band of tarred cotton. To protect the cable from any violent discharge of atmospheric electricity, lightning conductors, with a good earth connection, have been put up at each end, outside the tunnel.

Electricity on the Elevated Roads.

President Morton, of the Stevens Institute, on being interviewed in regard to the feasibility of the application of electricity to the elevated roads of this city, said:

"I heartily concur in the general conclusion that the scheme to substitute electricity for steam as motive power on the lines of the Manhattan Railway is perfectly feasible. I should not put the maximum of saving at more than 30 per cent., and the actual amount might be much less. I see that the most of the men who have motors to introduce make the minimum about 30 per cent. and confidently predict a saving of 50 per cent."

"But you do not think there is any doubt about the advantage of introducing electricity as motive power on the elevated railways?"

"No, the case is very different from that of the utilization of electricity generally. I am perfectly sure that electricity will be both cheaper and pleasanter than steam power for the trains of the Manhattan Company?"

"And do you also have faith in the project to have elevators operated by electricity at all the stations?"

"Undoubtedly elevators can be operated in that way, although the current required will be greater if elevators as well as trains are to be moved by the same force. The whole question is one of expense."

"You wish to caution investors not to expect a boom, then?"

"Yes, electricity is likely to take the place of steam power gradually, rather than with a boom, and many credulous electricians will be sadly disappointed. Mr. Edison says his two best assistants came from the Stevens Institute, and we are keenly interested in electrical science here, but 10,000 mechanical engineers are wanted to every ten electricians, and it would be a mistake for a very great number of young men to determine to devote themselves to electrical enterprise. We may expect great things from electricity, but we must not expect them all to arrive in one day."

Western Union's Report.

The quarterly report of the Western Union Telegraph Company for the quarter ending Sept. 30, 1884, shows the following items: Surplus, July 1, 1884, $4,157,468.89; net revenues, $1,545,529.17. Deducting the following appropriations: Dividend of 1¼ per cent. paid Oct. 15, $1,399,807.49; interest on bonded debt, $124,000; sinking funds, $20,000; a surplus was left on Oct. 1 of $4,159,190.57. The net revenues of the quarter ending Dec. 31, based upon nearly complete returns for October, partial returns for November, and estimating the business for December, will be about $1,500,000, to which the surplus on Oct. 1 is to be added, making $5,659,190.57. Deducting from this amount the interest on bonded debt, $124,000, and sinking funds, $20,000, leaves a balance of $5,515,190.57. It requires for a dividend of 1¼ per cent. on capital stock $1,199,837, and deducting this from the balance leaves a surplus of $4,315,353.57. A dividend of 1¼ per cent., payable on Dec. 30, has been declared.

Telephone Service Up the Hudson.

For several days the Hudson River Telephone Company has been stretching wires between Storm King Mountain and Breakneck, on opposite sides of the Hudson River. The Storm King is 1,524 feet high, and Breakneck nearly as high. The stretching of this lofty wire will complete telephonic connections between New York, Newburg, Albany, Troy and Saratoga. Newburg is the centre of a vast telephone system. It is connected with every town of importance in the river counties. When the wire spanning the Hudson is in place New York will be in communication with the whole Hudson Valley system. President James Bigler, of the telephone company, says communication will be established next Monday.

THE TELEGRAPH.

THE MIDLAND RAILWAY CO., ENG.—The English Midland Co. employs on its telegraph system 15,100 miles of wire, 1,556 single-needle instruments, 3,890 block instruments, 2,500 block bells, 1,010 signal repeaters, 380 light repeaters, and 860 other instruments. The Swan lamps, with a few Hammond incandescents, are used by this company.

MRS. STAGER'S WILL.—In Chicago, on the 2d inst., General Anson Stager, formerly second vice-president of the Western Union Telegraph Company, was appointed executor of the last will of his deceased wife, Rebecca, who died Oct. 22. The will is dated Feb. 7, 1880, and disposes of $15,000 worth of property, of which $12,000 is real estate in Cleveland, Ohio. The husband inherits the entire estate.

THE VALUABLE MESSENGER SERVICE.—The ingeniousness of the district messenger finds new fields for development as the service increases and the number of "schemes" attempted by swindlers keeps up with the times. The A. D. T. Co.'s force is over 1200 and requires services of detectives constantly, and from its own ranks the best talent is developed. Chas. Mavelin, the boy detective, is winning many laurels in this direction, which will soon place himself in the front ranks of skillful detectives.

IN THE U. S. COURT.—A few days since application was made to the United States Circuit Court at Philadelphia, for an order allowing the receivers of the Bankers and Merchants' Telegraph Company to settle with the receiver of a construction company which built the telegraph property. The plan is for the telegraph o mpany to take the property and issue receivers' certificates in payment therefor, and has been concurred in by the Supreme Court of New York, but the matter was held under advisement by the U. S. judges.

THE SOUTHERN TELEGRAPHIC CO. IN TROUBLE.—In Norfolk, Va., on Friday, 5th inst., in the United States Circuit Court, a bill was filed by Senator William Mahone, suing for himself and others similarly situated, as a bondholder and stockholder of the Southern Telegraph Company, charging fraud and mismanagement on the part of the officials of said company, and praying for an injunction, the appointment of a receiver and the winding up of the company's affairs. The litigation involves bonds amounting to $2,500,000. A temporary restraining order was granted by the court, the marshal was ordered to take custody of the affairs of the company, and the case was set for further proceedings on Dec. 19. The company is in default for interest, and, it is said, in danger of irreparable bankruptcy.

THE TELEPHONE.

ENTERPRISE ON THE CONTINENT.—The London *Times* states that a plan is being considered for establishing telephonic communications between Brussels and Paris.

GERMAN IDEAS.—The lawyers of Berlin have united in establishing a room in the law courts, whence telephonic wire is laid to their offices, and the members of this legal telephone exchange are thus enabled to communicate with their clients until the very beginning of a suit.

SOCIAL TELEPHONISTS.—The National Telephone Company, Limited, of London, on the night of Nov. 21st, held its fourth annual conversazione in the Victoria Halls, West Regent street. In an address delivered during the evening, Mr. W. A. Smith, Director, Chairman, said that the number of people benefited by the progress of the compaay had increased a hundred-fold, and the revenue one hundred per cent. He mentioned that the number of calls in the National Telephone system alone for the month previous amounted to 684,000.

A LOSS TO THE SCIENTIFIC WORLD.—The death of M. Henri Lartigue, at Paris, on Nov. 19, is a severe loss to the scientific fraternity. His career was mostly in connection with railways, but he experimented much in electrical apparatus and invented a large number of devices applicable to railway working. He was a member of the Consulting Committee of French Railways, and when the Société Generale des Telephones was incorporated at Paris, by the amalgamation of the several independent comcompanies, M. Lartigue was elected its manager, and to his ability and energy the success of that enterprise is largely owing.

THE ELECTRIC LIGHT.

THE E. L. IN IOWA.—The City Council of Keokuk, Iowa, have decided to adopt an ordinance for the lighting of that city by the Badger Electric Light Company, and the plant will be erected in a short time.

ANOTHER E. L. CO.—In Pittsfield, Mass., an electric light company has been formed, with a capital stock of $50,000. The officers are: Abel Wheeler, Pres.; Edw. S. Sears, Treas., and these officials with Mr. Frank A. Sawyer, constitute the board of directors.

IN PRISON.—Experiments are being made under order of the Austrian Minister of Justice with the electric light in the prisons of the empire. If it gives the results which are confidently expected it will be adopted for Prague and Marbourg, where new prisons are now in course of construction.

GERMANTOWN, Pa.—The Germantown Electric Light Co., of Germantown, Phila., using the Thomson-Houston system, started up Friday evening, the 12th, with about fifty lights subscribed for. It is expected to soon increase to 100 lamps. Charles F. Smith is superintendent and general manager.

LIGHTNING LUNACIES.—In England, and doubtless elsewhere, there exist many strange popular fallacies concerning lightning, among others: That chewing the splinters from a tree struck by lightning will cure the tooth-ache; that such splinters will not burn; that the bodies of those killed by lightning shock do not become corrupt, and that no one is killed by lightning while asleep.

THE ELECTRIC LIGHT IN SPAIN.—The *Sociedad Española de Electricidad* has been intrusted by the Spanish Minister of Marine with supplying all the electrical accessories required for the arsenals and men-of-war, especially for the electrical lighting of the ships, three vessels of the navy being already supplied with arc lamps. The shops of the Marquinista Terrestrey Maritima Company, at Barcelona, are lighted by 32 arc and 20 incandescent lamps, while those of Fioly Vives, at Centillas, have been fitted with 80 incandescent lamps.

MR. GEO. S. BROCK has disposed of his interest and withdrawn from the general management of the Wright Travis Electric Co. and taken the general agency for the sale of the Ball unipolar system of electric lighting. Mr. Brock was formerly connected with the United States Electric Co., of Pennsylvania. He organized companies and introduced their system into a number of towns, notably Lancaster, Reading, Allentown, Pottsville and Pittston. He is very generally known throughout the State, in connection with electric light matters.

THE E. L. IN FOREIGN DOCKS.—For over three years the Port of Havre, France, has been employing the electric light in unloading vessels, and its use has now been extended to its graving docks. Three Gramme regulators, the height of which can be altered with decagonal reflectors, are provided for each quay, the current being led by overhead wires on ordinary telegraph posts. Two F Gramme dynamos, with a special engine, are placed in the building which contains the pumping engines for emptying the docks. Each dynamo supplies two circuits, each with three lamps, while a switch near each lamp permits of turning its current on or off. Sautter and Lemonnier, of Paris, furnished the plant.

ELECTION IN THE EDISON COMPANY.—The Board of Directors of the Edison Electric Illuminating Company, elected for the ensuing year, at the annual meeting of the stockholders, on the 9th, are Eugene Crowell, T. A. Edison, E. H. Johnson, C. E. Chinnock, Charles Batchelor, R. L. Cutting, Jr., J. Hood Wright C. H. Coster, F. R. Upton, E. D. Adams, Spencer Trask, Erastus Wiman, and F. F. Smithers. The new members are Messrs. Johnson, Chinnock, Batchelor, Cutting, Adams and Smithers. They take the place of Messrs. S. B. Eaton, Henry Villard, G. P. Lowrey, J. F. de Navarro, C. T. Christiansen and F. S. Hastings. The stockholders decided to break ground early next spring for a plant to take in all the large hotels, theatres and resorts up town.

A SAW-MILL LIGHTED BY ELECTRICITY.—In a saw-mill in South Wales an incandescent plant is now in successful operation. The Swan lamps for the offices are in movable fittings and very convenient. In the laboratory is a self-regulating Crompton-Burgin dynamo, capable of maintaining seventy-five 20 candle incandescent lamps. Accumulators supply current to the lamps when the engine is not working. The laboratory is generally lighted by six lamps, but as many as a hundred may be turned on when required for experiments. Twenty-four lamps are distributed about the mill, being, as a rule, placed over the benches, but they may be drawn down close to the work, brought underneath the benches, or moved about wherever required. It is computed that such lighting, for 1,100 hours per annum, costs about the same as gas, while for 3,000 hours it is 50 per cent cheaper.

TO DETERMINE THE LEGAL STANDARD OF LIGHT.—A practical way of producing the light standard as adopted by the Paris International Electrical Congress is pointed out by Dr. Werner Siemens. Platinum at the point of solidification readily takes up foreign substances, which change the point in question; hence Dr. Siemens prefers to determine the light given out by the platinum at its melting point, which with pure platinum is about the same as in the other case. The platinum surface, in the form of a thin sheet of foil, is inclosed in a metallic case provided with a hole 0.1 square centimetre in section, the hole being just in front of the foil. The sides of the hole are conical, and the foil completely closes it up all round. A current of electricity is sent through the foil until it fuses, and at the instant of melting a quantity of light equal to 0.1 of the legal standard is emitted from the hole. By suitably graduating the electrical current, the melting point of the platinum can be delayed until all is prepared to make the comparison with another light. Experiments show that the light emitted from the opening is about 1½ times the British standard candle.

ST. ENOCH'S STATION, GLASGOW.—At the terminus of the Glasgow and South Western Railway, in that city, is St. Enoch's Station, said to be one of the very first in the United Kingdom to use the electric light, and the experiment has not been particular successful heretofore, on account of the prime motor being put to many other uses in the station. Three firms have tried to work this plant and were forced to give it up. The directors of the railway company then erected a new engine and boiler house, and now Messrs. Anderson and Munro, electrical engineers, of Glasgow, will "run the lights" with every chance for successful working. There will be in use three dynamo machines, 34 Brush arc lamps, and between 200 and 300 incandescence lamps. Two of the machines will each provide current for 17 Brush lamps, and the other will be a Victoria 300-light dynamo. In the station proper there are to be 32 arc lamps in four lines of eight each, and the remaining two will light the booking hall. In the hotel adjoining the station, where gas has hitherto been exclusively employed, the incandescence lamps will be chiefly placed.

UNDERGROUND E. L. WIRES IN ENGLAND.—The Kinetic Engineering Co., of London, will introduce underground electric light cables, in several streets in Greenock. These cables will be of the Berthoud-Borel type, insulated with the B-B. material and encased in a double sheathing of lead, the two sheathings being separated by a layer of gas-tar. They will be tarred and laid in a bed of fine sand placed in the bottom of a trench and covered with the same to a depth of about four inches. Wood or brick is then placed over the sand to indicate the presence of the cable to workmen who may dig down to it. The cables will be of three types, namely, the main cable, consisting of 36 strands of copper wire, 1.5 millimetres in diameter, the branch main consisting of 12 strands of 1.6 millimetres, and the leads for the lamp posts consisting of 1 strand of 1.2 millimetres diameter. A conductivity of 96 per cent. and an insulation of 1,000 megohms per mile at the ordinary temperature are guaranteed. A considerable number of these cables have been laid in the manner described, in many of the principal continental towns, and all are reported as giving complete satisfaction.

THE ELECTRIC LIGHT IN PARIS.—The illumination of the Grand Opera in Paris by electricity has for several years been eagerly sought for by the various electric light companies, it being considered as the central point of departure for various proposed combinations for public lighting of different adjacent quarters from one great power station. The Grand Opera and its surrounding wealthy neighborhood is the only point in the city where an installation so extensive could be undertaken with any reasonable hope of success. Some months ago the Edison Company proposed a general scheme for such lighting, the central station to be placed in the Rue Caumartin, and to supply 22,000 lamps, distributed among private houses, cafés, clubs, etc., and of the number, 6,000 at the Opera. The station was to contain engines of 2,500 h. p., provided with steam by a group of Belleville boilers, and fourteen dynamos, as well as ample secondary battery capacity. This extensive scheme, to cost about half a million of dollars, never flourished very extensively, and its chances are rendered less by the recent death of M. Vaucorbeil, director of the Grand Opera, his successor being disposed to continue the use of gas, which will be furnished at a reduced price.

MISCELLANEOUS NOTES.

ANOTHER NEW BATTERY.—The joint invention of M. de Leland, a French chemist, and Mr. Berger Spence, of Manchester and London, is a battery formed by immersing a zinc plate in a cell formed by an ordinary iron dripping pan containing a layer of oxide of copper and a solution of caustic potash, or soda, and placing a number of these pans or cells in circuit, being isolated from one another by glass insulators.

MAGNETIZED RAILS.—By experiments upon the tracks of the

N. Y. Central R.R., with the galvanometer, it has been determined that electric currents flow through the rails continuously. The movement is generally toward centres of electric disturbance, and is perceptibly affected by the passage of cars; fast passenger trains being much more effective than freight or coal trains. One steel rail at Rochester was so much affected as to become a permanent magnet.

THE RUBBER TRADE OF BRAZIL.—By a law just passed in the province of Amazonas, Brazil, a fine of $1,000 is prescribed for tapping of rubber trees above 2½ metres from the ground, the tapping of any trees less than 25 years old, or the injury or destruction of young plants. A like sum is offered as a premium for each thousand trees planted and cultivated, when they arrive at two years of age, and other favors are held out to induce extension of rubber tree growing. A duty of $5,000 is levied on every rubber plant, and $100 on every kilogramme of rubber seed exported, in order to guard against or prevent foreign competition.

AN ELECTRIC GOVERNOR.—The *Industrial World* of Dec. 4th says: A novel feature in electric lighting has been on exhibition at the Globe Iron Works of H. A. Streeter, Chicago, during the week, consisting of an electric governor which regulates the motive power of the engine generating the electric current. By means of this device, when by chance or design a portion of the electric lights are turned out or additional light turned on, the admission of steam, and consequently the power of the engine, is regulated so as to be just sufficient to keep the lamps still burning and prevent the production of excessive electricity and the consequent danger from fire. The inventor is Mr. Amet.

THE CHOLERA AND ELECTRICITY.—A visitor to a cholera hospital of Paris was told by the physician in charge that he had been trying both continuous currents of electricity and ice, and that the former had done good work. The employment of electricity in such cases is by no means new, for in a book by the late Mr. Alfred Smee, F. R. S., entitled "Elements of Electro-Biology," and printed in 1849, the writer mentions that the alimentary canal is very easily affected by a current of electricity, and continues: "I have heard that electricity has been advantageously employed at the Free Hospital to rally a patient n the collapsed stage of cholera—a fact which I mention here, as this disease involves to a great extent the functions of the alimentary canal."

ELECTROLYSIS OF CRUDE METALS.—The extracting of pure metals from their ores, by the process of electrolysis was probably the earliest work to which dynamo-electric machines were put for commercial purposes. A hundred weight of refined copper can be, by this process, obtained from the bath at the expense of an equal quantity of coal, and many of the works in Germany, where most are located, have an output of from 20 to 50 cwt. of the pure metal per day. This might be further increased if every advantage were taken of latest acquired knowledge on the subject. The same process could be most advantageously applied to the extraction of other metals; magnesium, for instance, could probably be produced pure at the rate of $2.50 a pound, and, in view of the superior penetrating powers of the magnesium light in a fog, capital invested in thus obtaining it would find large returns.

AN ELECTRICAL EXHIBITION IN PARIS.—On the occasion of its first general assembly, in Paris, January 1885, the Société Internationale des Electriciens will hold an exhibition to comprise a collection of apparatus illustrating the discoveries and improvements made up to the present time, and a summary of the progress realized will be given by means of lectures by the most illustrious savants and distinguished electricians. Admiral Mouchez, manager of the Paris Observatory, has placed at the disposal of the society a suite of rooms in which the Exposition will be given. All native and foreign electricians, whether members of the Society or not, who desire to take part in the affair, must send in their applications, indicating the nature of the objects to be shown, before the 25th of the present month, to M. le President de la Société Internationale des Electriciens, 3 Rue Segnier, Paris. Due notice will be given of the exact date for the opening and closing of the exhibition. Cost of carriage and installation will be the only expense which exhibitors will have to incur.

APPLICATIONS OF POWER.

AN ELECTRICAL ENTERPRISE ABANDONED.—In 1882 the English Parliament sanctioned the construction of an electric railway from Waterloo station, under the River Thames, to Northumberland avenue. The promoters of the enterprise have, however, decided to abandon it and dissolve the company.

ANOTHER ELECTRIC MOTOR.—L. G. Woolley, of Indiana, has invented an electric motor which weighs but three pounds, but is said to be capable of lifting over half a ton one foot in one minute, and of driving a shuttle sewing machine 1,000 stitches a minute, at an average running expense of $2.60 per year. A stock company is now being organized to manufacture this motor.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange, and elsewhere are as follows:

TELEGRAPH.—Am. Cable, b 53, a 53½; B. & M., b 1¼, a 4; Mutual Union, b 12½; Postal stock, b 2½, a 3; Postal sixes, b 31; Western Union, b 61½, a 61¾.

TELEPHONE.—Am. Bell, b 262, a 263; Erie, b 18, a 19; Mexican, b 1⅝; New England, b 38, a 39; Tropical, b 1⅝.

The Boston *Herald* of Dec. 9 says:

Bell telephone was again active and again higher. The stock seems to have latent pyrotechnic forces within itself, which are sufficient to shoot the price upward on short notice. It rose to-day to 266, a gain of 11 points from Saturday. Later it sold off to 264½, and was 263 asked after the board. The issued capital is $9,602,100, and the authorized capital $10,000,000. There are also convertible notes of the value of $3,000 outstanding. The transfer-book contains the names of about 1700 stockholders. It is said that the company has no plan for the immediate increase of its capital, but asks the Legislature to authorize an increase of $10,000,000, with a view to cultivate the long-distance telephone field as opportunity offers. It is presumed also that the company wishes to increase its grip upon the sub-companies as opportunity offers, with a view to secure a literal monopoly of the telephone field in the United States. Whether the Legislature will grant the prayer of the company in the matter of increasing the capital is not certain. It asked for $15,000,000 when the company was incorporated, and got $10,000,000. It could probably build all the long distance lines required in the next five or ten years from the profits of its present business, and the natural increase, always supposing that the shareholders would rest satisfied with 12 per cent. interest on their stock at par. If the company is to continue its extra dividends, making the stock a 15 per cent. investment, or even a larger one on the par basis, more capital will certainly be needed to enlarge operations, and the larger the capital the smaller the apparent dividend, and the more willing, perchance, the people to pay heavy rentals for telephones.

ELECTRIC LIGHT.—Edison, b 40.

BUSINESS NOTICES.

THE STANDARD ELECTRICAL WORKS.—This most enterprising and reliable company, with the factory located in Cincinnati, O., have, to meet the demands of their increasing trade, established an Eastern Agency, at No. 109 Liberty street, in this city, for special sales of any kind of Telegraph, Telephone, or Electrical instruments and supplies, either standard, special or made to order. In charge of this agency is the gentleman who was formerly Superintendent of the Standard Works, Mr. Charles Anderson, than whom no more thoroughly posted and genial gentleman is in the electrical business, and all communications addressed to or visits paid him will result in prompt satisfactory attendance.

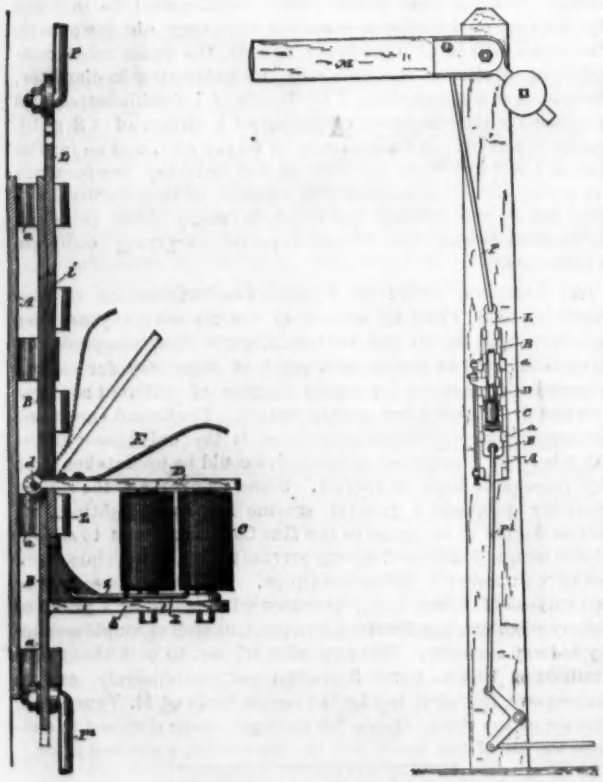
OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

Edited by EDWARD P. THOMPSON, M. E., Electrical Expert, 9 Murray Street, New York.

PATENTS DATED NOV. 25, 1884.

Apparatus for Controlling Railway Appliances by Electricity; J. T. Hambay, Pittsburgh, Pa., Assignor to the Union Switch & Signal Co., of same place..... 308,494

If the blade *M* is required to stand normally in a horizontal position by the action of a counter-balance when it is desired to indicate "danger" and to be drawn downward through the agency of the lever and connecting-rod to indicate "safety," then the device will be operated in precisely the usual manner of such apparatus so long as the electro-magnet *C* remains vitalized;



but whenever the electro-magnet is demagnetized by the interruption of the circuit traversing its coils or by the short-circuiting of the battery normally connected therewith, then, although the system of actuating levers and rods may be actuated, yet the signal-blade *M* will remain in horizontal position, for the reason that the mechanical connections between the movable plates *L* and *B* has been interrupted. The blade *M*, or other equivalent signal device which may be employed, is compelled by means of a counter-balance or other like device to automatically move into position to indicate "danger" when not positively held in position to indicate "safety" by the downward pull of the rod *P'* acting through the plates *B* and *L*.

Apparatus for Controlling Railway Signals by Electricity; J. T. Hambay, Pittsburgh, Pa., Assignor to the Union Switch and Signal Co., of same place..... 308,492

Consists in coupling the signaling device with the mechanical actuating power by which it is actuated by means of an electro-magnet which is normally maintained in a magnetic condition. The electro-magnet is capable of being raised and lowered at will by a cord passing over pulleys and leading to the operator's cabin. Upon the signal disc is fixed an armature for the electro-magnet, and when the electro-magnet is vitalized the armature is attracted with sufficient force to raise the disc into a position to indicate "safety," provided the electro-magnet itself be raised by the cord. When, however, the electric circuit is interrupted or the battery is short-circuited, the disc or signal device will not be moved, for the reason that no attractive force exists between the electro-magnet and its armature.

Circuit Closer for Railway Switches; J. T. Hambay, Pittsburgh, Pa., Assignor to the Union Switch and Signal Co., of same place..... 308,493

Consists in inclosing a movable circuit-controlling plate within a cast-metal case, which may be rendered water-tight in any convenient manner. A piston-rod attached to this plate extends outside the case, and this rod is normally held in position by the tension of a spring. Against one side of the rod rests a contact plate or brush which at all times completes the connections of a main electric conductor leading from the exterior of the case with the rod or with the movable block attached thereto. Two insulated contact-surfaces are provided at other points upon this plate or block, and two circuit-changing contact-springs are provided for continuing the connections of the first-named contact-spring to one or the other of two electrical conductors. One of the last-named contact-springs is designed to rest against the corresponding insulated surface, while the remaining spring is in contact with the metal of the block and vice-versa.

Electro-Magnetic Car-Coupler; J. D. Reed, York, Neb..... 308,432

The invention consists partly in the combination with a car of a pivoted shackle on the draw-head, an electro-magnet for operating the shackle, conductors for conducting the electricity to the electro-magnets, contact-strips on the ends of the cars for uniting the conductors of the several cars, and in numerous parts and details and combinations of the same, as will be fully set forth and described hereinafter.

Electricity Gauge; J. G. & H. M. Goodman, Louisville, Ky..... 308,487

Consists of a pendent vibratory electro-magnet of mechanical devices adapted to operate clock-work to register the vibrations of the pendent electro-magnet, and arms for making and breaking the electric circuit.

Electro-Mechanical Signaling Apparatus; M. Toulmin, Washington, D. C..... 308,533

Consists in the combination, with the time indicating hand detachably connected with the power mechanism, of an electro-magnet adapted to break said connection, and means to operate the hand in a reverse direction, and means to re-establish said connection when the hand reaches Zero, whereby it is put under the influence of power mechanism and moved to indicate time.

Electric Time Detector; A. Lasmoles, Chatauroux, France..... 308,416

Comprises a train of clock mechanism, operated from a suitable power, and appliances whereby a total record of the operations of the sub-station electro-magnets and a permanent record of each operation thereof, as well as a record of the time when made, are obtained, and an audible signal is given at each operation of the sub-station electro-magnet.

Electro Mechanical Clock; C. H. Pond, New York, N. Y..... 308,521

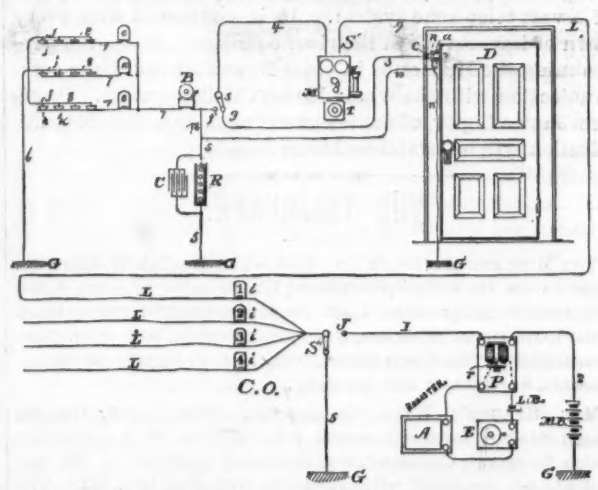
This invention is based upon the employment, in connection with an ordinary clock-movement which is driven by a spring or weight, of an electro-magnetic motor which periodically winds the spring or weight. Each clock is constructed in such a manner that it may operate independently of other clocks, or may be one of a series controlled by a central clock.

Electric Motor; G. Trouvé, Paris, France..... 308,534

The armature is provided with a core presenting polar surfaces which are eccentric to the axis of revolution, or the surfaces of the core are concentric with the axis of revolution, while the exciter presents curved surfaces which are eccentric to the said axis.

Combined Telephone and Fire Alarm System; T. D. Lockwood, Malden, Mass..... 308,566

The several lines are shown as each passing through an electro-magnetic annunciator, *i*, and by means of a switch, *s'*, to a common ground-wire, 5, which represents the normal condition of the circuits at the central station. The switch *S'* may, when the alarms are set at the sub-stations, be turned on to the stud *J*, thus disconnecting the main lines from the ground-wire 5, and connecting them with the ground through the relay *P* and the bat-



tery *M B* by means of the wires 1 and 2. The said relay controls the circuit of the local battery *L B*, which circuit includes a signal-bell, *E*, and a register, *A*, and is normally open at the relay-points *r*. When the relay is energized by the closing of the main circuit, and the consequent activity of the battery *M B*, the local circuit is closed, and the alarm-signal is struck upon the bell *E* and recorded on the register *A*.

Electric Motor; A. D. Blodgett and J. P. Tirrell, Boston, Mass., Assignors to the Electric Signal Clock Co., of Mass..... 308,548

Consists of an electro-magnet which is excited intermittently and caused, when excited, to give motion to a pawl or dog engaging with the teeth of a ratchet-wheel, said pawl or dog being thus moved intermittently and caused to rotate the ratchet-wheel and drive the connected mechanism step by step.

Mechanical Telephone; J. F. Tucker, Sumner, Mich., Assignor of one-half to M. W. Tucker, of same place..... 308,582

Consists of a metallic diaphragm supported at or near its periphery upon an edge of the bowl, said bowl constructed with a cup-shaped sounding chamber back of the diaphragm and a cup-shaped projection in front of the diaphragm.